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ABSTRACT

This report documents and evaluates the activities of the Urban Mathematics Collaborative (UMC) project during the 1988-89 school year. UMC seeks to improve mathematics education in inner-city schools and identify new models for the professional development of mathematics teachers by supporting collaboration among mathematics teachers and mathematicians from institutions of higher learning and industry. Teachers are encouraged to identify with and participate in a broad-based local mathematics community. The project is currently operating in 11 cities across the country. A variety of qualitative and quantitative methods were used to evaluate the project. The following summary findings are presented: (1) the Education Development Center (EDC), a nonprofit research and development organization, assumed more responsibility for management of the project, freeing the technical assistance component and the outreach component to spend more time helping individual sites with substantive problems; (2) individual collaboratives began to view themselves as members of a larger network that could accomplish greater goals as a result of constant pressure from EDC; (3) individual sites need to develop firmer management structures; and (4) the sites did achieve some common goals because of the unifying focus provided by EDC and because many sites had resolved basic issues of finance and organization. Descriptions of the 11 UMC collaboratives are included. A list of 10 references and summary reports from the 11 collaboratives are appended. (FMW)

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March 1990

Program Report 90-1

# The Urban Mathematics Collaborative Project: Report to the Ford Foundation on the 1988-89 School Year

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**Norman L. Webb, Susan D. Pittelman, Thomas A. Romberg, Allan J. Pitman, James A. Middleton, Elizabeth M. Fadell, and Marilyn Sapienza**

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**Wisconsin Center for Education Research**
**School of Education, University of Wisconsin - Madison**

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Program Report 90-1

# THE URBAN MATHEMATICS COLLABORATIVE PROJECT: REPORT TO THE FORD FOUNDATION ON THE 1988-89 SCHOOL YEAR

Norman L. Webb, Susan D. Pittelman, Thomas A. Romberg
Allan J. Pitman, James A. Middleton, Elizabeth M. Fadell, and Marilyn Sapienza

Report from
the Urban Mathematics Collaborative Documentation Project

Wisconsin Center for Education Research
School of Education
University of Wisconsin
Madison, Wisconsin

March 1990

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# I. INTRODUCTION

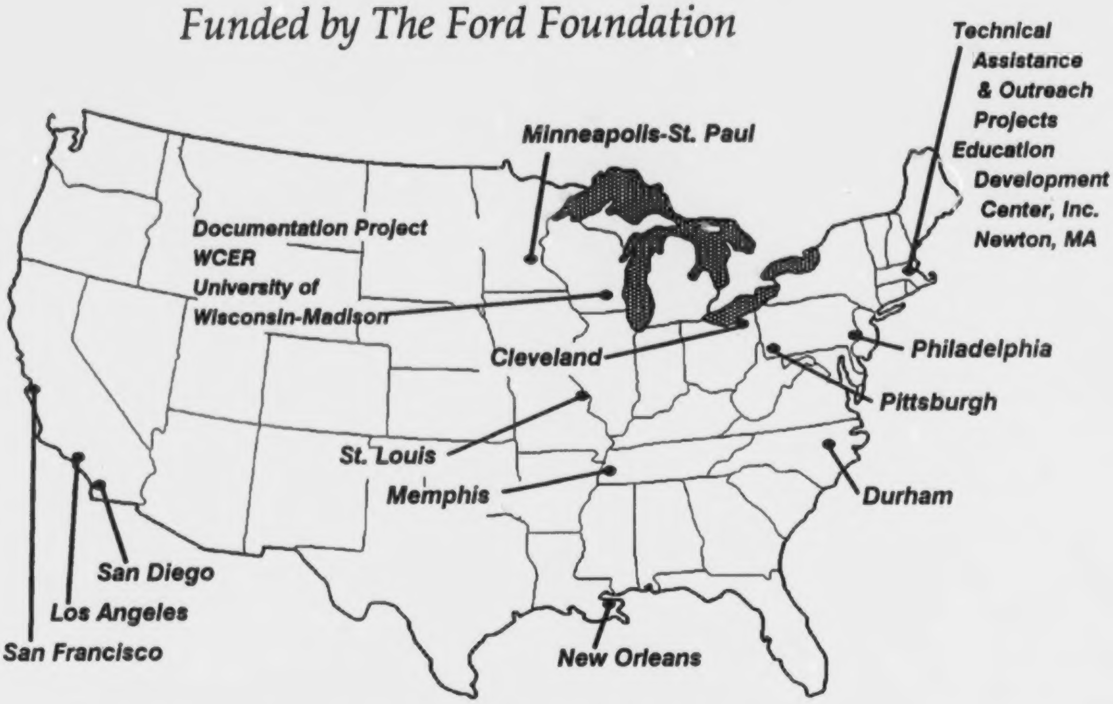
In 1984, the Ford Foundation initiated the Urban Mathematics Collaborative (UMC) project to improve mathematics education in inner-city schools and to identify new models for meeting the ongoing professional needs of teachers. In February, 1985, the Ford Foundation awarded five grants to establish urban mathematics collaboratives in Cleveland, Minneapolis-St. Paul, Los Angeles, Philadelphia and San Francisco. In addition, the Ford Foundation established a Documentation Project to monitor the activities of the new collaboratives and a Technical Assistance Project (TAP) to serve as a source of information for the collaborative projects (Romberg & Pitman, 1985). During the next 18 months, UMC projects were funded in Durham, Pittsburgh, San Diego, St. Louis, Memphis, and New Orleans, bringing to 11 the total number of urban mathematics collaboratives (Romberg, Webb, Pitman, & Pittelman, 1987; Webb, Pittelman, Romberg, Pitman, & Williams, 1988; Webb, Pittelman, Romberg, Pitman, Fadell, & Middleton, 1989). In August, 1987, an Outreach Project was funded to publicize and expand the UMC effort. A map of the UMC project appears in Figure 1.

In each of the 11 cities, the UMC project continues to support collaboration among mathematics teachers, and between teachers and other mathematicians from institutions of higher education and industries, and to encourage teacher membership and participation in a broad-based local mathematics community. Since the project's inception in 1984, it has become clear that the teacher is and will remain the hub of the educational process. But it also has become evident that many teachers--and especially those in inner-city schools--are overworked, lacking in support and material resources, and isolated from their colleagues, from other professionals, and from the rapidly changing field of mathematics.

The collaborative project remains rooted in the premise that collegiality among professional mathematicians can reduce teachers' sense of isolation, foster their professional enthusiasm, expose them to a vast array of new developments and trends in mathematics, and encourage innovation in classroom teaching. The Ford Foundation's concomitant commitment of human and financial resources provides a support network to allow such collegiality to take place.

# The Urban Mathematics Collaborative Project

*Funded by The Ford Foundation*


Technical Assistance & Outreach Projects
Education Development Center, Inc. Newton, MA
Minneapolis-St. Paul
Documentation Project
WCER
University of Wisconsin-Madison
Cleveland
Philadelphia
Pittsburgh
St. Louis
Memphis
Durham
San Diego
Los Angeles
San Francisco
New Orleans

- **Cleveland Collaborative for Mathematics Education (C$^2$ME)**
  Cleveland, Ohio
- **Durham Collaborative: The Durham Mathematics Council**
  Durham, North Carolina
- **Los Angeles Urban Mathematics/Science/Technology Collaborative (LAUM/S/TC)**
  Los Angeles, California
- **Memphis Urban Mathematics Collaborative**
  Memphis, Tennessee
- **New Orleans Mathematics Collaborative (NOMC)**
  New Orleans, Louisiana
- **Philadelphia Math Science Collaborative**
  Philadelphia, Pennsylvania
- **Pittsburgh Mathematics Collaborative**
  Pittsburg, Pennsylvania
- **St. Louis Urban Mathematics Collaborative**
  St. Louis, Missouri
- **San Diego Urban Mathematics Collaborative**
  San Diego, California
- **San Francisco Mathematics Collaborative**
  San Francisco, California
- **Twin Cities Urban Mathematics Collaborative**
  Minneapolis-St. Paul, Minnesota

**Figure 1.** The Ford Foundation National Network of Urban Mathematics Collaboratives.

An important element of the network is the administrative support provided by the Technical Assistance Project, the Outreach Project, the Documentation Project and the Ford Foundation. The Technical Assistance Project was established in September, 1985, to provide a broad range of technical assistance to the Urban Mathematics Collaborative project as a whole, as well as to the 11 individual collaboratives. The project is directed by Dr. Mark Driscoll at the Education Development Center, Inc. (EDC), a non-profit research and development organization located in Newton, Massachusetts. Under his direction, the project has provided each site with assistance in solving local problems and identifying local resources; provided encouragement as well as financial support for collaborative members to participate in national and regional symposia, workshops and pilot projects; kept the sites informed of the status and direction of mathematics curriculum reform; facilitated communication and fostered networking among the 11 collaboratives; established priorities for the project such as focusing on equity and on the NCTM Curriculum and Evaluation Standards for School Mathematics (1989); and offered guidance to each collaborative in its efforts towards permanence.

The Outreach Project was created in fall, 1987, to complement the efforts of the collaboratives by disseminating information about the unique nature of the local initiatives, and by providing the collaboratives with a national voice in the arena of education policy and reform. A third responsibility of the Outreach Project is to offer assistance to other communities seeking to replicate or adopt important features of the UMC model. The Outreach Project is directed by Dr. Brian Lord and administered by EDC. During the 1988-89 school year, the Outreach Project issued a request for proposals for replication grants to support activities at sites interested in starting collaboratives. By the closing date of June 15, 1989, five proposals had been received.

The Documentation Project at the Wisconsin Center for Education Research at the University of Wisconsin-Madison was established in 1984 to record the progress of each collaborative in defining, redefining, and refining its concerns. In December, 1987, a case study component of the project was initiated to conduct case studies on one or two teachers at each site. Six sites were studied during 1987-88 and five during 1988-89.

The efforts of each project, as well as those of the Ford Foundation itself, merit study for three reasons. First, each project and the Ford Foundation need to be kept informed about what is happening; ongoing activities, the strategies employed, and the effects of those activities on the professional lives of teachers and other project participants need to be documented in order to be shared. Second, it is important for the projects, the Ford Foundation, and the educational policymaking community to understand the characteristics and relationships inherent to each project. Because changes occur over time, the activities, the actual changes in behavior, the anticipated and unanticipated outcomes, and the impediments encountered under varying circumstances must be identified and studied. Third, although each site is unique, the data will enable us to identify project activities and strategies that can be generalized to different settings. This is especially important now that other sites are beginning to establish collaboratives. By encouraging mathematics teachers to act as self-directed professionals, the collaboratives are generating strategies that can be used with teachers of all subjects.

The Documentation Project provides each of the collaboratives with a broader view of its place in the overall UMC project. It offers the projects an attentive audience and serves as a source of information about how other sites are dealing with similar issues, and advice on problems common to all sites. The staff also provides professional expertise in mathematics education when such input is requested.

The Ford Foundation Program Officer, Dr. Barbara Scott Nelson, has been a visible spokesperson for the collaboratives. She has visited with key personnel at each site, bringing the prestige and power of the Ford Foundation to each project's efforts to gain local support. She has been a mentor, mediator and a problem-solver, consistently supporting the collaborative projects as they strive toward the collaborative vision that guides all of the efforts of the UMC project. Dr. Nelson's involvement, however, is tempered by the goal and expectation of the Foundation that the collaboratives will become self-sufficient over time and will continue to serve teachers long after Ford funding terminates. Dr. Nelson was less visible to the project in 1988-89 in light of this goal and the increasing role of EDC in the day-to-day operation of the project.

The urban mathematics collaboratives have assembled local resources--both financial and human--and have configured them in a variety of ways to explore new modes of professionalism for teachers and new kinds of relationships between mathematics teachers and the professional users of mathematics in higher education and in business. Considered individually, each collaborative is a unique, locally controlled project. But viewed as components of a wide-reaching national network, they comprise an efficient, cost-effective and comprehensive field experiment that is enhancing participating teachers' knowledge and professionalism as it serves as a testing ground for new modes of thought and fresh approaches to larger issues of professional enrichment and subject-area expertise.

Consonant with the Foundation's original intent, each of the 11 collaboratives has been encouraged to develop as a unique program, drawing on local resources, exploiting local strengths, and addressing local weaknesses. As the effort continues, the UMC project will focus more specifically on the effects of the developing networks on the professional lives of the participating teachers and on the identification of issue-based outcomes. The Foundation's intent in the UMC effort is in keeping with the recommendations of the Conference Board of the Mathematical Sciences (1984):

> The Conference recommends the establishment of a nationwide collection of local teacher support networks to link teachers with their colleagues at every level, and to provide ready access to information about all aspects of school mathematics. (p. 5)

The broad sense in which the term colleague is used is exemplified by the objectives "strongly endorsed by the Conference":

- to extend the sense of professionalism among teachers by building a support system that links them to colleagues in the mathematical sciences, inside and outside of the schools;

- to provide teachers at all levels with colleagues upon whom they can call for information concerning any aspect of school mathematics; and

- to enable teachers to enlarge their views of mathematics, their source of examples, and their repertoire of classroom skills in communicating mathematics. (CBMS, 1984, p. 15)

Since the project's inception in 1984, the Foundation has been increasingly successful in its aim to involve participating teachers at each site in a diverse set of activities and interactions that are planned and implemented to reflect the concerns and professional priorities of the teachers, as well as mathematicians from educational, cultural and business institutions. In all cases, these activities and interactions have been designed to ensure that teachers are viewed as professionals who bring to the exchange their unique viewpoints, perspectives and experiences, rather than as clients who "receive" information from other partners in the relationship.

Data about the collaboratives have been collected from a variety of sources, including:

1. the directors and coordinators of each project;
2. the on-site observers from each project (reflecting the teachers' perspectives);
3. visits by the staff of the Documentation Project;
4. discussions with teachers;
5. joint meetings with personnel from the Ford Foundation, the Documentation Project, the Technical Assistance Project and the Outreach Project;
6. meetings of the project directors, project coordinators, and mathematics supervisors;
7. meetings of representatives of all of the projects;
8. teachers at the UMC Teacher Leadership Conference;
9. surveys administered to participating teachers; and
10. demographic questionnaires completed by the school district.

This report presents an overview of the efforts of the UMC project as a whole, as well as a brief description of each of the collaboratives. The Appendix to the report includes a detailed progress report for each of the collaborative projects for the 1988-89 school year.

## II. PROJECT DESCRIPTIONS

A brief description of each of the 11 Urban Mathematics Collaboratives is presented in this section. (A more detailed report of each collaborative is appended to this paper.)

## Cleveland Collaborative for Mathematics Education ($C^2ME$)

Director: Ms. Barbara Patterson
Coordinator: Ms. Charniece Buford Holmes (through May, 1989)
On-Site Observer: Mr. Robert Seitz
Funding Agent: The Cleveland Education Fund
Date of Initial Funding: February 1, 1985

The Cleveland Collaborative for Mathematics Education ($C^2ME$) was one of the five original collaboratives established in 1985. The collaborative, which serves the approximately 200 secondary and intermediate school mathematics teachers in the Cleveland Public Schools, is administered through the Cleveland Education Fund.

$C^2ME$'s purpose is to enhance the quality of mathematics education in the Cleveland Public Schools by finding new ways to integrate community resources into the teaching process and by defining new models for meeting the continuing professional needs of teachers. The collaborative has defined its mission as enhancing the professionalism and effectiveness of intermediate and secondary school mathematics teachers in the Cleveland Public Schools by providing opportunities for collegiality, training/professional growth, and curriculum development.

The Advisory Board and the Teacher Advisory Board provide input to the collaborative's director and project coordinator. The Advisory Board, which oversees the operation of $C^2ME$, is comprised of representatives of science, education, and business, as well as nine mathematics teachers from the Cleveland Public Schools. The Teacher Advisory Board was established in early 1986 to assist the collaborative in developing its long-range plans and future activities. Teachers were selected to serve on the Board based on their participation in $C^2ME$'s programs and on their dedication to excellence in mathematics education in the Cleveland Public Schools. In fall, 1987, membership in the Teacher Advisory Board was expanded from 11 to 17 teachers.

During the 1988-89 school year, $C^2ME$ offered a wide variety of activities designed to provide teachers with opportunities for training, information, collegiality, and networking with their colleagues, as well as with mathematicians from business, industry, and higher education. The collaborative sponsored four workshops, a dinner symposium, and an end-of-year dinner to honor retiring teachers; initiated the Problem-Solving Infusion Project to develop ways to incorporate problem-solving into the seventh and eighth grade mathematics curriculum; served as a conduit for the funding of AETNA Math Clubs; initiated and supported mathematics contests; and provided funding for teachers to attend regional and national workshops and conferences. In addition, the collaborative continued to publish its own quarterly newsletter; encouraged participation in Cleveland's Teacher Internship Program; helped to facilitate the John Carroll University scholarship program, through which teachers receive awards to cover the cost of college coursework; and encouraged teachers to apply for small grants provided by the Cleveland Education Fund. The collaborative's multi-purpose Resource Center continued to offer a variety of services and support to Cleveland mathematics teachers.

## Durham Collaborative: The Durham Mathematics Council

Director: Dr. J. Keith Brown
Executive Director: Dr. Helen Compton (until June 1, 1989)
On-Site Observer: Ms. Betty Peck
Funding Agent: The North Carolina School of Science and Mathematics
Date of Initial Funding: August 1, 1985

The Durham Mathematics Council was established in August, 1985, as the sixth collaborative in the Urban Mathematics Collaborative project. The collaborative, which serves 127 secondary and middle school mathematics teachers in the Durham city and county school systems, is administered through the North Carolina School of Science and Mathematics (NCSSM).

Now in its final phases of development, the collaborative has identified specific objectives for out-of-school activities, in-school activities, and network activities. These objectives are designed to continue the professional growth of teachers, to enhance their teaching of mathematics, and to reduce their isolation within the district and from area mathematicians. It is the ultimate goal of the Durham Mathematics Council that teachers assume control of their own professional experience and status.

The collaborative's Board of Directors assists the project director and the executive director in guiding the project's focus and activities. The 16-member board is comprised of representatives from area businesses, higher education, and the city and county schools, including two teachers. The Steering Committee, comprised of at least one teacher from each school, was established to provide a direct link between the teachers and the collaborative administration.

The programs of the Durham Mathematics Council are designed to encourage middle school and senior high school mathematics teachers to communicate with their colleagues in all areas of professional mathematics. During the 1988-89 school year, the Council sponsored a wide variety of activities for Durham teachers, including workshops and seminars, receptions, and meetings of teachers in five subject areas. DMC also helped to organize and promote meetings of the Triangle Math Club and played an integral role in conducting the follow-up session to the national 1987 NCSSM Summer Workshop. In addition, DMC awarded travel grants to enable members of the Council to attend state, regional and national conferences; program grants to develop new curriculum materials and prepare workshops; and mini-grants to fund the purchase of classroom materials. The collaborative also expanded the scope and quantity of the materials available through the Teacher Resource Center and continued to publish its own newsletter monthly during the school year.

## Los Angeles Urban Mathematics/Science/Technology Collaborative

Executive Director: Ms. Peggy Funkhouser
Project Director: Ms. Toby Bornstein
On-Site Observer: Mr. Richard Curci
Teacher Coordinator: Kathy Blackwood (appointed March 1989)
Funding Agent: Los Angeles Educational Partnership
Date of Initial Funding: February 1, 1985

The Los Angeles Urban Mathematics/Science/Technology Collaborative (LAUM/S/TC) was organized in mid-1986 as a result of a restructuring and reorientation of the Los Angeles Urban Mathematics Collaborative, which was established in 1985 as one of the five original collaboratives. LAUM/S/TC is the official title of the 57-member Advisory Committee, which reported to its funding agent, the Los Angeles Educational Partnership (LAEP). During 1988-89, the Advisory Committee was reevaluated to identify the organizational structure that would provide the most meaningful guidance to LAEP in its operation of five programs: +PLUS+ (Professional Links with Urban Schools), Industry Initiatives in Science and Mathematics Education (IISME), Model Technology Project, Target Science and TELE-Venture. The +PLUS+ project constitutes the urban mathematics collaborative originally initiated through funding from the Ford Foundation.

The collaborative has focused its attention on high schools in four districts: The Los Angeles Unified School District (LAUSD), El Monte Union High School District, Inglewood Unified School District, and Pasadena Unified School District. In light of the massive target population, the collaborative's +PLUS+ project focused initially on the mathematics departments in three high schools. During the collaborative's first year, the departments in these schools formed +PLUS+ teams with local business and post-secondary associates. Two of these departments continued in the program after the first year. In spring, 1987, the +PLUS+ project was expanded to include five additional schools and in spring, 1988, seven more departments were added, bringing the total number of active +PLUS+ departments to 14 by the end of 1987-88. In 1988-89, the +PLUS+ department that had withdrawn from the project reactivated, seven additional departments joined the collaborative, and a department that had joined the collaborative in 1987 withdrew, resulting in a total of 21 +PLUS+ departments. Each department, with the exception of the seven that joined the collaborative during the 1988-89 school year, is represented on the Teachers' Council, a forum for departmental leadership that meets once a month during the school year.

The +PLUS+ project's goal is to broaden teachers' mathematical horizons by encouraging them to interact with their colleagues in a mathematics resource network, and to help them relate the mathematics curriculum to the world of work. The +PLUS+ initiative in 1988-89 involved two major efforts. The first focused on improving the mathematics programs of the 22 high schools, with the +PLUS+ team in each target school either preparing or executing plans for an enhanced curriculum. Considerable effort has been expended in building these teams, with the goal of fostering and consolidating departmental cohesion. As a prerequisite to receiving financial support to implement its plan, each department agreed to define needs, explore resources, and develop a program of activities. In addition, the seven 1988 departments were required to host department site meetings at their schools.

The second major effort of +PLUS+ for 1988-89 was directed towards the third annual +PLUS+ Workshop Series. Mathematics teachers from all Los Angeles County Schools are eligible to attend, although emphasis is placed on encouraging teachers from the four targeted school districts to participate. Under the auspices of the +PLUS+ project, a steering committee comprised of teachers planned this year's series.

During the 1988-89 school year, the collaborative instituted both the Jaime Escalante Mathematics Teacher Award Program and a series of classroom demonstration lessons by +PLUS+ teachers. The collaborative also sponsored a conference for teachers from +PLUS+ departments, an event expected to be held annually. In addition, TELE-Venture, the electronic bulletin board which allows free exchange of information among the mathematics teachers at +PLUS+ schools, was expanded to include the new +PLUS+ departments as well as district instructional specialists. The collaborative sponsored a Woodrow Wilson Geometry Institute and follow-up workshop, funded attendance of +PLUS+ teachers at several local and national workshops and conferences, and encouraged teachers to apply for grants offered through the LAEP. The collaborative also began to publish a monthly newsletter.

## Memphis Urban Mathematics Collaborative

Executive Director: Mr. Herman Ewing
Project Coordinator: Ms. Nancy Gates
Associate Coordinator: Ms. Anne White
Workshop Coordinator: Ms. Donna Porter
On-Site Observer: Ms. Rita Ross
Funding Agent: Memphis Urban League, Inc.
Date of Initial Funding: September 1, 1986

The Memphis Urban Mathematics Collaborative, established in September, 1986, was the last of the 11 collaboratives to join the UMC project. The collaborative serves the approximately 350 middle, junior high and senior high schools mathematics teachers in the Memphis City Schools. The collaborative is administered through the Memphis Urban League, Inc.

The Memphis collaborative's primary goal is to create and promote an environment in which mathematics teachers can develop an individual and collective sense of professionalism through a variety of enrichment activities, and establish beneficial relationships with mathematics professionals in the business and university sectors.

The collaborative's organizational structure has evolved gradually since 1986. The collaborative is governed by a 23-member Advisory Committee comprised of seven teachers; six mathematics professors and representatives from higher education; four from business and industry; two from the school district administration; the director, who also represents the Urban League; the project coordinator; and the newly appointed associate coordinator and workshop coordinator. A Teacher's Committee of 14 teachers serves as a sounding board for teachers' views about collaborative activities. Late in 1987-88, a Permanence Committee was established to begin work on the permanence proposal to the Ford Foundation; its first meeting was scheduled in July, 1988. A Think Tank Committee, convened for the first time in March, 1989, completed the permanence proposal.

During the 1988-89 school year, the collaborative offered a wide array of activities, programs and services to mathematics teachers in the Memphis City Schools. These included 1988 summer workshops, a dinner symposium on mathematics reform, a dinner meeting for the Geometric Supposer user group, a colloquium and reception, a one-day workshop on mathematics for the 1990's, visits to a kindergarten classroom to observe a mathematics program, a two-day curriculum review workshop, and a five-day June workshop on mathematics applications. The collaborative also sponsored teachers' attendance at a variety of professional activities, including an August, 1988, NCSSM follow-up session; the NCTM annual meeting; a Woodrow Wilson Summer Institute; a Phillips Exeter conference; and several conferences held in summer, 1989. Three teachers worked as summer interns in 1988. The collaborative continued to sponsor a Speakers Bureau and to publish its biannual newsletter.

### New Orleans Mathematics Collaborative (NOMC)

Director: Ms. Kimberley Sawyer (appointed July 1, 1988)
Coordinator: Dr. Olympia Boucree
On-Site Observer: Ms. Aldonia Winn-Belton
Funding Agent: The Metropolitan Area Committee (MAC) Foundation
Date of Initial Funding: September 1, 1986

The New Orleans Mathematics Collaborative, established in 1986, was the tenth of the eleven collaboratives to be funded by the Ford Foundation. The collaborative, which serves the approximately 150 senior high school mathematics teachers in the New Orleans Public Schools, is one of four programs coordinated by the Metropolitan Area Committee Education Fund. In addition, 136 middle and junior high school mathematics teachers are invited to attend some of the large group affairs.

The collaborative's aim is to enhance the professional development of mathematics teachers and to enrich the teaching of mathematics in New Orleans' public secondary schools. To accomplish these goals, the collaborative has provided teachers with opportunities to develop networks with mathematicians from business and higher education, to work in collaboration with other teachers and mathematicians, to stay abreast of new developments in mathematics and teaching, and to understand the importance of mathematics in "real world" settings.

The collaborative is governed by a 22-member Steering Committee comprised of teachers, district administrators, and representatives from the teachers' union, businesses, universities, and the Louisiana Science Centre. The committee chairman, who is chief Executive Officer of Shell Offshore, Incorporated, also sits on the MAC Education Fund Board. Four subcommittees--symposia, site visits and internships, workshops, and the newsletter--oversee collaborative activities. The Teacher Advisory Council, established in 1987, is composed of a teacher representative from each of the 19 core curriculum senior high schools. The Council allocates funds to allow teachers to attend conferences, provides input in identifying activities, and serves as a conduit for the flow of information between the collaborative and teachers.

During the 1988-89 school year, the New Orleans Mathematics Collaborative sponsored a wide variety of activities, including a dinner symposium series that incorporated a follow-up workshop; four site visits to local businesses and industries; a Woodrow Wilson Summer Institute; a workshop on Science and Math Anxiety; and an end-of-the-year meeting, at which teachers discussed issues relating to equity. The collaborative also expanded its Industry Internship Program, encouraged teachers to apply for mini-grants, and sponsored teachers' attendance at regional and national conferences. In addition, the collaborative published its newsletter four times during the year.

## Philadelphia Math Science Collaborative

Director: Dr. Wayne Ransom
Coordinator: Ms. Sue Stetzer
PRISM Collaborative Liaison: Emily Meyers
On-Site Observer: Ms. Joyce Neff
Funding Agent: The Franklin Institute
Date of Initial Funding: February 1, 1985

The Philadelphia Math Science Collaborative was established in fall, 1986, through a restructuring and reorientation of the Philadelphia Mathematics Collaborative, one of the original five collaboratives. The collaborative, which serves mathematics and science teachers in the School District of Philadelphia, is administered through the Franklin Institute. During the 1988-89 school year, the number of its target schools increased from nine to 13.

The goals of the Philadelphia Math Science Collaborative are to promote teacher leadership and team building and to contribute to a vision of mathematics and science teaching in the future. Specifically, the collaborative hopes to: (l) develop, evaluate, and document the position of an in-school collaborator who would facilitate communication and serve as a catalyst for change and (2) increase teacher participation in extramural professional development programs that offer partnerships between teachers and their colleagues in academia and industry; opportunities to enhance knowledge, skills, and professionalism; and new ideas for mathematics instruction. The collaborative also hopes to develop a model for documenting the impact of these two programs on the quality of teachers' professional lives.

The collaborative is governed by two committees: The Steering Committee and the Program Planning Committee. The Steering Committee is responsible for the overall governance of the collaborative, while the Program Planning Committee is responsible for planning decisions. Both committees are composed of teachers from the target schools, as well as representatives from local colleges, businesses, the school district, PRISM (Philadelphia Renaissance in Science and Mathematics) and other professional organizations.

In addition to encouraging teachers to participate in the enrichment opportunities available to them in the Philadelphia area and providing teachers in the target schools free or partially funded memberships in their local professional organizations, the collaborative sponsored several activities during the 1988-89 school year. These programs included grants to fund teachers' attendance at professional meetings, workshops, and seminars; the Mathematics, Science and Technology Conference, which focused on integrating technology into the curriculum; monthly programs for software users; assistance and support for teachers wishing to apply for PRISM grants; a series of student seminars; a network for teachers using the Geometric Supposer; a monthly calendar and newsletter; ACCESS, a network of support materials for teachers of Mathematics in Applications; and a clearinghouse service that keeps teachers notified of resources for classroom use.

## Pittsburgh Mathematics Collaborative

Project Coordinator: Dr. Leslie Salmon-Cox
Collaborative Liaison: Ms. Barbara Bridge
On-Site Observer: Ms. Rosemarie Kavanagh
Funding Agent: Allegheny Conference on Community Development
Date of Initial Funding: September 1, 1985

The Pittsburgh Mathematics Collaborative, the seventh collaborative to be funded, was established in 1985 to serve the 115 high school mathematics teachers in the Pittsburgh public schools. The collaborative is administered through the Allegheny Conference Education Fund, which is administered by the Allegheny Conference on Community Development.

The collaborative's efforts focus on six goals: to overcome teachers' isolation by providing increased opportunities for interaction; to educate the community as to the professionalism of high school mathematics teachers; to enhance teachers' knowledge of mathematics and its applications; to provide teachers with opportunities for professional self-enhancement; to provide opportunities for teacher recognition; and to provide time for teacher interaction, work, and professional development. These goals are envisioned as positive steps toward institutionalizing structures and processes that will continually foster teacher professionalism and that will be decreasingly reliant on external administration and facilities.

Collaborative governance is shared among five bodies: the Steering Committee; its Executive Committee, called the "First Tuesday Committee"; the Collaborative Liaison Committee; the Secondary Instructional Teacher Leaders from each of the 12 high schools; and the Middle School Instructional Teacher Leaders from each of the 16 middle schools. The 27-member Steering Committee, comprised of teachers, school district administrators, college and university faculty members, and representatives from various community councils, corporations, and foundations, meets annually to discuss the collaborative's direction and activities. The Executive Committee, comprised of two collaborative staff members and three administrators from supporting agencies, meets the first Tuesday of each month to plan and review the daily operations of the collaborative. The Liaison Committee, made up of one representative from each high school, meets quarterly during the school year. The Instructional Teacher Leader Groups meet monthly during the school year to plan and evaluate specific activities. The Instructional Teacher Leaders also serve as the major communication channel between the collaborative and the teachers.

During the 1988-89 school year, the Pittsburgh Mathematics Collaborative offered a variety of activities and programs designed to enhance professionalism and collaboration among high school mathematics teachers and professionals in the mathematical sciences, as well as to provide teachers with information about mathematics applications. This year, with the initiation of the Middle School Mathematics Project funded by a grant from the National Science Foundation, the collaborative extended its services to include middle school mathematics teachers. Collaborative activities included receptions, in-service programs, committee dinners and workshops, and a math-intensive partnership program. The collaborative also published a newsletter, Graphiti, for secondary and middle school mathematics teachers, and encouraged teachers to apply for professional development grants that enabled them to take advantage of a variety of opportunities, including attendance at professional conferences and workshops.

## St. Louis Urban Mathematics Collaborative

Director: Dr. Helene Sherman
Council Chairperson: Ms. Anita Madsen
On-Site Observer: Mr. Donald Thompson
Funding Agent: Mathematics and Science Education Center
Date of Initial Funding: April 15, 1986

The St. Louis Urban Mathematics Collaborative was one of the four collaboratives established in 1986. The collaborative, which serves the 101 secondary mathematics teachers and 13 computer science teachers in the St. Louis Public School District, is administered through the Mathematics and Science Education Center. The center, which was established in fall, 1986, assists schools and districts in providing quality education in mathematics and science.

The primary goals of the collaborative focus on providing teachers with opportunities: to explore business-, industry-, and university-based resources, and to determine how these resources may assist them in their professional growth and classroom instruction; to develop and implement staff training programs for themselves and for their peers; to improve communication and information exchange among mathematics teachers, both within and across schools; and to promote recognition of accomplishments and quality performance among all mathematics teachers and students. These goals were derived from secondary mathematics teachers' expectations that the collaborative would improve their knowledge of mathematics and its applications, and would increase their communication, collegiality, instructional expertise, and feelings of professionalism.

The collaborative operates under the direction of the Collaborative Council, comprised of 13 teachers from the St. Louis Public Schools; three representatives from the academic and business communities; the district's three mathematics supervisors; the director of the Partnership Program; a representative of the school district's Division of Technology Development; and the collaborative's director. The Council meets once each month to discuss, plan, and evaluate collaborative events, and nearly all decisions affecting the collaborative are determined by Council vote.

During the 1988-89 school year, the collaborative sponsored a wide variety of activities for high school mathematics teachers in the St. Louis Public Schools, including a technology conference, two seminars focusing on mathematics education in other countries, a dinner symposium, the second annual Mathematics Fair and Secondary Mathematics Contest, two social gatherings, and subject-area study groups which were instituted during the 1988-89 school year. In addition, the collaborative sponsored teachers' attendance at a variety of local, regional and national workshops.

## San Diego Urban Mathematics Collaborative

Director: Prof. Alma Marosz
Co-Director: Dr. Mary Koehler
Coordinators: Dr. Frank Holmes
Ms. Jean Childs-Moore (through March, 1989)
Dr. Barbara Wyman (appointed April, 1989)
On-Site Observer: Dr. Sharon D. Whitehurst
Funding Agent: San Diego State University Foundation
Date of Initial Funding: April 15, 1986

The San Diego Urban Mathematics Collaborative, established in spring, 1986, is administered through the San Diego State University Foundation. During the 1988-89 school year, the collaborative served approximately 150 mathematics teachers from nine targeted schools: five senior high schools and four feeder junior high schools in the Sweetwater Union High School and the San Diego Unified School districts.

The collaborative's primary goal is to improve the professional lives of mathematics teachers in the San Diego area by reducing their tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community.

The collaborative is governed by a project director, a co-director, two project coordinators, and the Executive Committee, which consists of mathematics specialists from the school districts and the county, teachers from the targeted schools, faculty members from San Diego State University, the collaborative director, co-director, and coordinators.

The Executive Committee's efforts have been largely directed toward instilling in teachers a sense of project ownership. The Executive Committee meets monthly to advise the collaborative staff on future plans, to provide feedback on activities, and to offer insights into teachers' needs.

In addition to encouraging teachers to take advantage of a wide array of local resources, the collaborative hosted a weekend retreat, a one-week summer workshop to introduce teachers to the curriculum material developed at the North Carolina School of

Science and Mathematics, a second workshop series based on the California Mathematics Framework, a cooperative learning workshop, and an industry applications tour. The collaborative also has paid $3 towards membership dues of the Greater San Diego Mathematics Council (GSDMC) for mathematics teachers in the target schools; encouraged and helped to facilitate teachers' applications for grants and scholarships; and offered stipends to teachers to enable them to attend several conferences and workshops, including the annual fall conference of the Southern Section of the California Mathematics Council, the Annual Greater San Diego Mathematics Conference, the national NCTM conference, and the Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy in New Hampshire.

## San Francisco Mathematics Collaborative

Executive Director: Ms. Gladys Thacher
Director of Programs and Evaluation: Ms. Judith Massey Morales
Project Coordinator: Dr. Robert Marcucci (through December, 1988)
Project Director: Ms. Lise Dworkin (appointed April, 1989)
Director of Development & Community Outreach:
Ms. Janice E. Toohey (through August, 1988)
On-Site Observer: Mr. Del Spicer (July, 1988-June, 1989)
Funding Agent: San Francisco Education Fund
Date of Initial Funding: February 1, 1985

The San Francisco Mathematics Collaborative was one of the five original collaboratives established in 1985. The collaborative, which now serves the 1,500 K-12 mathematics teachers in the San Francisco Unified School District, is administered through the San Francisco Education Fund (FUND) in close cooperation with the San Francisco Unified School District.

The vision of the San Francisco Mathematics Collaborative is one in which teachers are motivated, knowledgeable and accountable to their colleagues and to their students in their pursuit to become the best possible mathematics educators. Toward this goal, the basic functions of the collaborative are defined as: creating opportunities for meaningful dialogue among mathematics teachers in grades K-12; providing a "safehouse" where teachers can freely express their needs and concerns; providing teachers with opportunities for professional development and collegiality based upon a shared concern for mathematics education; developing a structure in which teachers can take the initiative in the improvement of mathematics teaching and learning; creating a vehicle for community investment in excellent mathematics education in San Francisco schools; and providing opportunities for teachers to discuss equity issues and the role of the collaborative in addressing these issues.

The newly-constituted Collaborative Council is the decision-making body for the collaborative. The Council is comprised of 22 voting members, including 12 teachers, two representatives of mathematics teachers associations, one school district representative, one FUND representative, one Exploratorium representative, two representatives from higher education, and three representatives from the business community. Beginning in April, 1989, the Council met monthly to plan direction, policy, and activities for the collaborative. A coordinating group consisting of the district's mathematics core curriculum team leaders, the collaborative project director, and the FUND's director of program and evaluation meets regularly to ensure that collaborative activities are aligned with the overall goals of the district and of the FUND. The new full-time project director is responsible for managing the day-to-day activities of the collaborative.

During the 1988-89 school year, the San Francisco Mathematics Collaborative offered a wide variety of activities that enabled teachers to establish networks with their peers and with other professionals, and increased their awareness of the developing world of mathematics and its applications. The 1988 Summer Teacher Institute at the Exploratorium and a series of follow-up sessions exposed teachers to applications of mathematics in the physical sciences. A series of workshops brought teachers together with recognized experts in mathematics education as well as in the mathematics sciences, provided an opportunity for collegiality, and offered teachers valuable insights into current efforts to bridge the gap between mathematical theory and application. The collaborative assisted teachers in applying for mini-grants and small grants awarded by the San Francisco Education Fund to support projects to enrich students' mathematics education. The collaborative also provided funds for teachers to attend local and national conferences and institutes offered by other organizations. To disseminate information about collaborative events and to provide an opportunity for mathematics teachers to share their ideas, the collaborative began to work cooperatively with the San Francisco Math Teachers Association to publish the SFMTA newsletter, The Exponent.

## Twin Cities Urban Mathematics Collaborative

Governing Board Chair: Mr. Steven Watson
Administrative Director: Prof. Harvey B. Keynes
Project Coordinator: Dr. Philip Carlson (appointed for the period November, 1988 - September, 1989)
On-Site Observer: Ms. Gerry Sell
Funding Agent: School of Mathematics, University of Minnesota-Minneapolis
Date of Initial Funding: February 1, 1985

The Twin Cities Urban Mathematics Collaborative was one of the five original collaboratives established in 1985. The collaborative, which serves the approximately 260 junior and senior high school mathematics teachers in public, private, and parochial schools within the boundaries of the Minneapolis and St. Paul school districts, is administered through the School of Mathematics at the University of Minnesota.

Since its inception, the collaborative has directed its efforts toward helping teachers to exercise more control over their professional lives; toward providing professional and educational opportunities for teachers; toward expanding the involvement of business and industry; toward integrating its efforts with those of other mathematics education organizations; and toward increasing its visibility, especially within the school districts.

During the 1988-89 school year, the collaborative operated under the guidance of the newly created policy-making Governing Board and the Building Representatives Group. The collaborative's goals for the year were to: continue the more successful activities; begin the transition to the new governance structure; identify a part-time executive director; raise funds, and begin the process of acquiring a nonprofit, tax-empt 501(c)3 status.

Under the new governing structure, collaborative policies are set by the 15-member Governing Board chaired by Steve Watson. Members of the board include teacher representatives, the administrative director, the executive director of the Minnesota High Technology Council, two representatives from higher education, the district mathematics consultants, two school board members, and two representatives from business and industry. The Building Representatives group, which discusses issues and makes recommendations to the Governing Board, is made up of 36 teachers, one from each public high school and junior high school in Minneapolis and St. Paul, and one each from seven private and parochial schools. These members serve as collaborative emissaries to teachers in their home schools, and the group has its own budget to fund its activities. The collaborative is administrated by Professor Harvey Keynes. Dr. Philip Carlson, a staff member of the Special Projects Office of the Mathematics Department of the University of Minnesota, was appointed as the part-time coordinator for the 1988-89 school year.

During the 1988-89 school year, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for junior and senior high school mathematics teachers. These included a series of four dinner meetings sponsored by the Twin Cities Mathematics Society (TCMS), and the development of Shareabilities, a directory of Twin Cities mathematics teachers willing to share their knowledge and special materials with other teachers. The collaborative also funded teachers to attend a variety of local, regional, and national conferences and workshops, including a one-week Woodrow Wilson Summer Institute on Statistics and Quantitative Literacy and a follow-up workshop. In addition, five issues of the collaborative newsletter, an important networking component of the project, were published and distributed. The newsletter, which had been co-edited by a teacher and the on-site observer, is now produced by the Special Projects Office of the University of Minnesota.

## III. THE UMC NETWORK

The Urban Mathematics Collaborative project is more than 11 isolated sites discovering what works best in their local situations to enhance the professional lives of teachers. As an explicit element of the Ford Foundation's vision of change, the collaboratives are connected by a shared support system to which they turn for services, ideas, help and direction. This support system is comprised of the program officer from the Ford Foundation, staff from the Education Development Center, Inc. (EDC), in Newton, Massachusetts and members of the Documentation Project at the University of Wisconsin-Madison. The services they provide, as well as the support the individual sites provide to one another, directly affect and help to define the total project, and their cooperative efforts have contributed to a cohesion and sense of common purpose that link all of the collaboratives.

The UMC project is a national network recognized by project administrators and teachers within individual sites as a key contributor to the development of collaboration on a variety of levels. UMC administrators meet each October at one of the 11 sites, and the directors, coordinators, and district mathematics supervisors each meet in their respective groups on separate occasions during the year. All but two sites in 1988-89 were linked by electronic mail, and a UMC project newsletter, umc <ANGLES>, is published and distributed to all sites. The UMC support network is on call to help the collaboratives as needed; a common request has been an invitation to the program officer to visit with top school district administrators, corporate chief executive officers, and prestigious community boards to help increase a collaborative's visibility and local support. In addition, EDC has invited collaborative teachers to special sessions at the NCTM annual meetings, and has provided encouragement and financial support to enable teachers to attend a variety of conferences, workshops and UMC activities. As a result, teachers at each site have become acquainted with their peers at other sites and the foundations of a broad-based collegial network have been established. As the impacts and value of the UMC project are considered, it is essential that analysis be founded on a firm understanding of the organizational context in which it operates; evaluation must consider not only the contributions the UMC support system makes to each of the 11 sites, but its own progress and development as well.

The support system is moving toward permanence or closure with the same deliberation and self-evaluation exhibited across all of the individual sites. In 1988-89, primary responsibility for project operations was shifted from the Ford Foundation to EDC. As this transfer was underway, EDC's project components, the Technical Assistance Project and Outreach Project, devoted extensive time and energy to identifying commonalities among the sites and a direction for the project as a whole. As a result of these efforts, a Standing Committee has been established, annual meetings are now focused on a particular topic or theme, and each staff component (i.e., collaborative directors, coordinators, and mathematics supervisors) has been asked to identify its goals and objectives.

In addition to these innovations, the Outreach Project initiated the process for expanding the number of sites by inviting other sites to submit proposals for collaborative planning grants. This expansion of the UMC network suggests that the collaborative model can be replicated in a wide variety of educational environments, even without substantial funding or the prestige of being associated with the Ford Foundation; its ready applicability to changing situations and environments enhances the UMC project's potential for impact. EDC continues to support and assist each individual site toward its own vision of permanence, including direct intervention in the case of three sites to facilitate their permanence process.

In addition to its regular activities, the Documentation Project began preparing in 1989-90 for its last year of data collection. This process included outlining the parameters of the final report and determining what data should be collected during the year. At the conclusion of its UMC participation, the Documentation Project will have produced six annual reports, including reports on each individual site; four technical reports based on data from large-sample surveys; a report summarizing the case studies in the 11 sites; 11 final site reports summarizing the evolution of the project at each site from 1985 through June, 1990; a final report to the Ford Foundation; and a book-length reflective analysis of the project (to be written in 1991).

During 1988-89, the UMC support system experienced a period of transition during which it set goals and monitored the project's growth and development. It is in this context that the efforts of each system component are described below.

## Ford Foundation

The 1988-89 school year was significant in the evolution of the UMC project in that the control of its operations was transferred from Project Monitor Barbara Scott Nelson and the Ford Foundation, to EDC. Although the ultimate responsibility for the project, including funding and grant decisions, remained with the Ford Foundation, day-to-day project operations were delegated to EDC in September, 1988. This transfer of duties suggests that the project monitor had determined that the UMC project had stabilized and did not need her constant attention. The transfer of responsibilities to EDC signified a step towards the development of a permanent configuration for the UMC project. Although the decision to assign this responsibility to EDC was made final in conversations between Barbara Scott Nelson and EDC representatives in the spring of 1988, it had been an expectation of Dr. Nelson from the early stages of the project. From its inception, it was anticipated that the Ford Foundation would play an operational role in the project only in its early formative stages. Because the Foundation is a funding organization rather than an operating agency, it becomes involved in such projects only on a preliminary basis and only until the projects become self-sufficient. The relationship between EDC and the UMC project was a major consideration when EDC was selected to provide technical assistance in 1985.

As a result of these transitions, changes in project leadership and focus occurred over the course of the year. The 1988 UMC Annual Meeting, for example, was the first such event that occurred without significant input from Dr. Nelson in the planning stages. Although she did present a paper on her perspective of the collaborative and educational reform, she did so at the invitation of the collaborative leadership; it should also be noted that her presentation described EDC's increased responsibility for project operations.

Some management activities were affected only slightly by this shift in roles and responsibility. The core group, consisting of Dr. Nelson and staff from EDC and the Documentation Project, met three times during the year, but the agenda was set by EDC staff. The permanence proposals submitted by the sites in May, 1988, and in May, 1989 were reviewed and discussed jointly by EDC staff and Dr. Nelson, with the final decision-making authority remaining with the Ford Foundation. As the agent of the Ford Foundation, Dr. Nelson determined that three of the sites' plans for permanence--one in 1988 and two in 1989--were in need of revision before funding could be approved. To facilitate this process, the Ford Foundation requested that EDC, as part of its function of providing technical assistance, work with these collaboratives to develop viable plans that could be approved.

## Technical Assistance Project (TAP)

The Technical Assistance Project, under the direction of Dr. Mark Driscoll of the Education Development Center, (EDC), continued to provide support and resources to the 11 collaboratives in 1988-89. Dr. Driscoll was assisted during the year by TAP Research Assistant Grace Kelemanik, and Administrative Assistant Sheila Flood. In addition to serving as a general resource to the projects, the TAP schedules and sponsors meetings for groups of collaborative members; manages the electronic network; helps to identify and sponsor guest speakers for various collaborative events; assists individual collaboratives in organizing conferences; helps fund teachers' attendance at national meetings; helps defray the cost of Woodrow Wilson One-Week Summer Institutes; intervenes to assist collaboratives in defining their approach to permanence; and networks with leaders in mathematics and mathematics education.

EDC's proposal to the Ford Foundation for the 1988-89 school year identified four broad areas that were to be the focus of the Technical Assistance Project's efforts during the year: substance, collaboration, teacher leadership, and community of collaboratives. In reporting its activities in the 1989-90 proposal, however, TAP organized its discussion around the general categories of governance, communication, and substantive issues. This change in the focus of the TAP's efforts reflects the evolution of the project to a stage in which more than half of the collaboratives were working toward permanence and a concerted effort was being exerted to establish a common voice for all 11 collaboratives. In this more mature state, most collaboratives had developed a system of governance and were becoming adept in identifying financial resources to support their continuation. Once this kind of stability had been achieved, it became possible for EDC to shift attention to establishing a strong network among the collaboratives and to developing teacher leadership to support and nurture that network.

### Substance in the Curriculum

To support teachers' efforts to introduce greater substance to their curriculum, the TAP continued to provide collaboratives with the resources to allow teachers to attend

NCTM national and regional meetings and Woodrow Wilson One-Week Summer Institutes. In addition, TAP arranged for consultants to work with individual collaboratives upon request and helped to identify other relevant resources, such as software and exemplary curriculum materials.

As the 1988-89 school year progressed, TAP's focus shifted to the issue of equity in recognition of the importance of this topic to all of the collaboratives. Panels were organized at the 1988 UMC annual meeting in Philadelphia and at the 1989 NCTM annual meeting in Orlando. The UMC Standing Committee also initiated data collection on the issue at each site; this information will be used for a variety of purposes, including input at the UMC Teacher Leadership Conference that EDC is sponsoring in August, 1990. Equity issues that drove some of the discussion during the year included the question of whether quality mathematics is available to students at all levels of proficiency and whether collaborative teachers need to reexamine and reevaluate their own views.

There was also a focus on mathematics reform, which included the innovations set forth in the NCTM Curriculum and Evaluation Standards. The Technical Assistance Project's efforts in this area included working with individual collaboratives to help them achieve goals related to the NCTM Standards; supporting the contribution consultants make to the collaboratives; exposing UMC teachers to the Australian Mathematics Curriculum and Teaching Program during the NCTM annual meeting; and moderating the networking of teachers who use the Geometric Supposer.

### Teacher Leadership

Another substantive area for the TAP involved teacher leadership. During the year, Dr. Driscoll and Ms. Daisley, assistant director of the Outreach Project, worked with a group of Philadelphia mathematics teachers to encourage their increased influence on and involvement in collaborative governance. This effort culminated in the teachers' proposal to EDC to fund distribution of information and materials derived from their conference attendance to their district colleagues. Dr. Driscoll also presented a symposium on teacher leadership in New Orleans in an effort to revitalize that collaborative's Teacher Advisory Group. In cooperation with the Outreach Project, TAP planned the Teacher Leadership Conference to be held in August, 1989, in Newton, Massachusetts. Finally, the TAP facilitated individual teachers' efforts to become more involved in collegial sharing by arranging for two teachers from Philadelphia to lead staff development workshops, one in

Dayton and one in Memphis, and for two teachers to serve as presenters with Ms. Kelemanik at the National Educational Computing Conference in Boston in June, 1989.

## Governance

EDC's efforts to assist the collaboratives in developing strong systems of governance during 1988-89 focused primarily on the sites' plans for permanence. In the fall, EDC activities included helping the San Francisco Urban Mathematics Collaborative to work through the planning process that produced its permanence proposal in December, 1988. In the winter and spring, EDC staff visited the four collaboratives that planned to submit their proposals in May, 1989. In Memphis and New Orleans, EDC staff attended collaborative meetings and guided the proposal as it evolved through several revisions. In San Diego and St. Louis, as in San Francisco, EDC identified an on-site consultant who was brought in to work with the collaborative as it finalized its proposal.

## Communication

Effective and open communication has been essential as the individual sites work to establish a cohesive network of teacher collegiality and educational reform. EDC and the Technical Assistance Project fostered communication across all sites in four key ways. First, key collaborative members from all 11 sites, as well as mathematics professionals from higher education, business and industry, were brought together at a variety of meetings throughout the year. These included UMC-sponsored meetings of collaborative members at the 1989 NCTM annual meeting in Orlando; the fourth UMC annual meeting in Philadelphia; and the day-long meetings held for individuals serving a common function across sites: directors, coordinators and mathematics supervisors. The TAP fostered communication across sites by convening the UMC Standing Committee in May, 1989, to assist in the design and planning of the UMC annual meeting and to provide leadership on issues of importance to all collaboratives, such as equity and teacher leadership. Third, the TAP has worked to develop ties between the UMC network and other national organizations, such as the American Mathematics Project (AMP) and the Mathematicians and Education Reform (MER) Network. As a result of these efforts, UMC co-sponsored a reception with AMP at NCTM, and mailing lists have been shred among these professional organizations. Finally, EDC continues to operate an electronic network, Common Ground, that includes members of UMC, as well as other interested individuals who contribute their expertise.

## Urban Mathematics Collaborative Annual Meeting

The fourth UMC annual meeting was held October 23-26, 1988, in Philadelphia. More than 70 collaborative participants attended, including the directors, coordinators, district mathematics supervisors, and on-site observers from each site; staff from each of the three support groups; and invited guests.

An opening reception was held Sunday night, featuring an address by Professor Bob Davis, a professor of mathematics education at the Graduate School of Education at Rutgers University. Davis opened the conference with a vivid description of his own vision of mathematics education and a discussion of his views on ways to help urban children learn mathematics.

Monday's session opened with an address on the state of the collaboratives by Barbara Scott Nelson, UMC Program Officer from the Ford Foundation, who described the collaboratives' use of energy and the value of energized teachers. A panel discussion followed, focused on the topic of "Curricular Change: The Teacher/Supervisor Dynamic." The five panel participants included three teachers, a coordinator and a district mathematics supervisor from across the collaboratives. Following the panel discussion, break-out sessions focused on "Upgrading the Basics," "Staff Development for the New Curricula" and "The Role of Technology." Mr. Alan McClelland, director of the National Science Foundation Private Sector Partnerships Program, highlighted the afternoon with a discussion of the private sector's perspective on mathematics education reform.

The third day of the UMC meeting opened with a presentation on "A Goal for the Future: Equity Models." Presenters included Manual Gomez, assistant vice-chancellor at the University of California-Irvine; and Arthur Powell, associate professor in the Academic Foundations Department at Rutgers University in Newark. Two collaborative members offered formal reactions to the presenters and discussion was then opened to the general audience. The fourth and final day of the meeting was devoted to sharing perspectives on the future, including identifying collaborative needs and initiatives. The discussion was opened by a panel of collaborative members who served different functions from across the collaborative project. The panel was composed of Ross Taylor, the mathematics supervisor from Minneapolis; Toby Bornstein, collaborative coordinator from Los Angeles; Sharon Whitehurst, collaborative on-site observer and district representative from San Diego; and Ed Young, a teacher from Cleveland. After the panel members gave their views about what a collaborative would look like in 1999, comments were received from the whole group.

Additional presentations included a report from the Documentation Project on teacher professionalism; an update on activities from the Outreach Project including the premier showing of the videotape, "Leadership and Learning," produced by the Outreach Project to promote the collaborative project; and a discussion led by EDC on how the collaborative could better use their resources and exploring possible cross-collaborative projects.

### UMC Directors Meeting

EDC sponsored a meeting for the project directors in Boston, on February 17, 1989. In total, 21 people attended, including the 11 collaborative directors, Barbara Scott Nelson, six EDC staff, and three members of the Documentation Project. The day-long agenda featured discussions of permanence, issues of concern, building deeper relationships, and other business, including the upcoming UMC Teacher Leadership Conference. The directors were asked to describe their collaborative's efforts and the issues that surrounded their work toward permanence. One director reported experiencing overt pressure from representatives of the business sector to produce evidence that the collaborative had improved student test scores. Other participants suggested that such demands could be best answered by asking representatives from the business community to help define the appropriate outcome measures. This comment prompted a broad discussion of assessment, with directors reporting on assessment issues at their individual sites. The group's focus then shifted to a discussion of equity. Herman Ewing, Executive Director of the Memphis Urban League and director of the Memphis collaborative, distributed a prepared paper describing what he perceived as an unwillingness among the group of collaborative to confront the issue of racial inequity within the context of the UMC project's goals and purposes. Equity must be made a "prominent priority," Ewing wrote, if teachers are to recognize its importance. The theme of equity continued to be a recurring topic of discussion for the remainder of the day long meeting. Other topics included teacher leadership, teaching, and teacher familiarity with the issues surrounding mathematics reform. One director noted, "Teachers need to be able to answer the question, 'Why do all kids need to take algebra?' Teachers cannot answer this." The meeting was characterized by collegial sharing and the open exchange of ideas and viewpoints.

The afternoon session focused on the question of renewal, the importance of drawing new participants into the collaborative process, and the means by which teachers can establish deeper and more beneficial relationships with their colleagues in the schools and in business and higher education. Subissues included the administrative structure, the budget, the varied levels of commitment exhibited by individual teachers, and the value of a strong base of support and advocacy for the collaborative. The meeting was concluded with a discussion of the UMC Teacher Leadership Conference scheduled August 6-11, 1989, in Newton, Massachusetts. The EDC staff presented a preview of the conference and listened to directors' ideas about the upcoming conference.

The meeting provided an important forum for collegial discussion of critical issues, the opportunity to offer input into EDC's planning processes, and an environment conducive to professional networking and the sharing of ideas. Although no real decisions were made by the group, the concerns that were expressed and the high level of commitment that was demonstrated by the directors motivated EDC to establish the UMC Standing Committee. It appeared to EDC staff that the UMC project had reached the stage at which it was ready to address issues as a unified project.

### UMC Coordinators Meeting

Seventeen people attended a meeting of the coordinators at the Chateau LeMoyne in New Orleans on February 11, 1989. Thirteen coordinators (two each came from San Diego and Philadelphia) participated, along with three staff members from EDC and one member of the Documentation Project. Agenda items included teacher leadership, UMC teacher network proposal, student outcomes/professional teacher outcomes, equity issues/curriculum reform, and announcements from the Documentation Project. Although most of the meeting was devoted to discussion, the group also concluded that the coordinators needed to exert greater influence and a stronger voice in collaborative development; it was agreed that, as a group, the coordinators would issue a position paper outlining their views on issues relating to collaboration and reform. Individuals assumed responsibility for writing particular sections, and it was decided that drafts of the paper would be shared at the NCTM annual meeting in Orlando. In the meantime, participants agreed to keep in touch with one another over the electronic network.

During the discussion on student outcomes and mathematics reform, the coordinators described how each of their collaborative was preparing for the release of the NCTM Curriculum and Evaluation Standards in March, 1989. In Twin Cities, for example, the collaborative was involved in planning a series of press conferences held around the state. In Cleveland, a special bulletin about the Standards appeared in the $C^2$ME newsletter. During this discussion, assistant director of the Outreach Project Janet Daisley, said that the project would prepare a press release on the Standards that would be distributed to each of the collaborative. All of the coordinators were encouraged to make efforts to draw public attention to the Standards and to use the occasion to increase the visibility of their own sites and of local mathematics education.

A significant amount of time in the afternoon was devoted to a discussion of equity. The group, in general, agreed that equity is an issue that must be discussed at a personal level and addressed at an institutional level. Although there was consensus that the issue must be addressed at all sites, there was no suggestion that any single approach would be successful in all circumstances. One aspect of the discussion was a shared acknowledgement that the level of mathematics necessary for success in the job market was increasing.

Other topics covered during the meeting included the upcoming UMC Teacher Leadership Conference to be conducted by EDC in August, teachers' increased willingness to assume leadership and responsibility in collaborative activities, and networking. EDC provided details on the leadership conference and the coordinators described the selection processes being used at each site to determine which teachers would attend. Some of the coordinators reported that they were working to transfer greater control of collaborative programs and planning to teachers; one coordinator, for example, suggested that many teachers feel uncomfortable critiquing their colleagues' work--such as grant proposals or programs--but that such constructive give and take was essential if the collaborative is to grow and maintain high standards. Another coordinator described the risks inherent in the shift from total administrative control to total teacher control. A third coordinator said the teachers view the collaborative as a service agency that will eventually come under their control. In the discussion of networking, EDC announced the formation of a UMC Standing Committee that will plan the annual UMC meeting and provide advice to EDC. Other networks were described including the Geometric Supposer network on Common Ground, the mathematics supervisor group, and similarly well-established programs such as EQUALS and Family Math. The meeting concluded with each participant asked to describe a "wish list." Wishes included taking more advantage of what other collaboratives have done, defining specific strategies to increase student enrollment in mathematics classes, attracting more underrepresented people into teaching, and developing more K-12 collaboration.

## UMC Mathematics Supervisor Meeting

Thirteen people attended the third annual UMC Mathematics Supervisor Meeting held at the Marriott Pavilion Hotel in St. Louis on May 13, 1989--ten supervisors representing nine collaborative sites, two EDC staff, and one member of the Documentation Project. Durham and Cleveland were the only collaborative that were not represented at the meeting. The day-long meeting was chaired by Winifred Deavens of St. Louis, who in conjunction with EDC developed the agenda based on suggestions from the mathematics supervisors. On the evening of May 12, the St. Louis collaborative hosted a reception for all of the participants.

The morning session was devoted to roundtable discussions of six key issues, with each discussion led by one of the supervisors: Les Winters, Los Angeles, discussed the role of the mathematics supervisor; Louvinia Wallace, New Orleans, discussed staff development models and constraints; Marietta Harris, Memphis discussed equity; Diane Briars, Pittsburgh, discussed collaborative permanence; Vance Mills, San Diego, discussed the Standards: communication/implementation; and Winifred Deavens, St. Louis, discussed calculators in assessment. The facilitator of each discussion offered opening remarks and shared some available literature; each supervisor then described the issue as it related to their individual districts. Many of the sites were experiencing changes in the role of the mathematics supervisor, a transition that resulted in some cases in a reduction in responsibility. Just one day before the meeting, Ms. Deavens had been notified that two of the three mathematics supervisor positions in St. Louis would be cut as of July 1, 1989, and that, based on her level of seniority, she would be returned to classroom teaching. The staff development discussion included comments on how best to use teachers as resources in providing staff development and release time. The discussion of equity described five barriers: testing practices, grouping and tracking, curriculum, school management systems, and teacher beliefs. Strategies for achieving a more equitable educational system included placing a high priority on equal access and eliminating bias in curricular materials. One approach to implementing the Standards reported by Vance Mills during the discussion on the Standards, included considering sections of the Standards by grade level and reviewing the summary of recommended changes. As part of this process, one of the Standards could be analyzed in depth at a department chair meeting to enable school administrators to become familiar with the focus and depth of the recommendations. At issue in the permanence roundtable discussion was the role and responsibility of supervisors as the collaborative work toward permanence, and the ways in which the supervisors could maintain their own collegial network. Participants in the discussion on calculators in assessment agreed that there should be a consistent use of calculators both in the curriculum and in assessment. Strategies toward this end include a review of current curriculum, using assessment as a vehicle for change, developing the assessment program to achieve particular goals, employing a range of assessment activities, and educating educators as well as the general public on the role and importance of assessment.

The afternoon discussion provided a forum in which the mathematics supervisors' group could directly address the issue of assessment and testing through the development of an action plan. Ross Taylor, of Minneapolis, served as discussion leader. The group's final activity involved listing a range of recommendations to guide their efforts; they included a national conference on mathematics assessment orchestrated by the National Center for Research in Mathematical Sciences Education; informing such special interest groups as the Association of School Boards concerning the issues surrounding reform; a proposal drafted by EDC for the development of tests that are compatible with the Standards; and searching for data on the relationship between instruction and test scores. It was agreed that EDC would draft a proposal seeking funds from some agency, such as the National Science Foundation, to make assessment instruments aligned with the Standards available to large urban school districts.

The issues that the supervisors addressed at the 1989 Math Supervisor's Meeting, as well as the leadership roles and responsibilities they assumed, are benchmarks of the group's growth. When the Technical Assistance Project first convened a meeting of the school district mathematics supervisors from each of the collaborative sites in December, 1986, it was with the intent of explaining the goals of the UMC project so that they would view the project as a vehicle that would complement, rather than inhibit, their own efforts to enhance mathematics education. The supervisors appreciated the opportunity to meet as a group and one commented that it was the first time they had done so. Since that meeting, EDC has continually encouraged the supervisors to maintain communication with one another across sites and to assume leadership roles in planning the group's meetings. The group has now reached a stage of development in which they are becoming aware of the impact urban mathematics supervisors can have when they speak as a united voice. As

Ford funding draws to a close, the supervisors are beginning to address the issue of permanence as it relates to their own network. They have become a cohesive group with its own agenda.

## UMC Activities at the NCTM Annual Meeting

At the NCTM Annual Meeting in Orlando, April 12 - April 15, 1989, EDC sponsored four activities for members of the Urban Mathematics Collaborative Project. From 5-7:30 p.m. Wednesday, EDC co-sponsored a reception with the American Mathematics Project in the Orange Room of the Park Suites Hotel. Over 100 people representing all 11 collaborative, as well as those associated with AMP, attended. Although the majority of the reception was devoted to socializing, Barbara Scott Nelson addressed the group, and then Elizabeth Stage of AMP and Mark Driscoll of EDC commented on each other's projects and on the state of mathematics education in general. For some participants, the reception represented their first collaborative event. One coordinator expressed concern that the meeting seemed to proceed as if all participants knew one another and were knowledgeable of the larger network, when in fact, this was to the case.

From 5-7 p.m. Thursday, nearly 80 people from the collaborative attended a program presented by four Australians on the Mathematics Curriculum and Teaching Program (MCTP) which had been developed in Australia. The presenters were Doug and Barbara Clarke, Max Stephens, and Charles Lovitt. Nancy Gates from the Memphis collaborative introduced the speakers. Charles Lovitt illustrated an idea for teaching linear equations that was developed through the collaborative efforts of teachers, emphasizing that the idea had to be tried and critically analyzed by other teachers before becoming part of the MCTP materials. Doug Clarke described some of the major concerns of teachers of mathematics: student achievement, apathy of teachers and students, teacher training, creativity and problem solving, sufficient time for reflection and analysis, the quality of the environment, isolation, and discerning valuable innovation from change for its own sake. Barbara Clarke then guided the audience in some hands-on activities by directing the group at each table to develop a story based on a time/distance graph depicting the movement of different people. Max Stephens concluded the program with notes on staff development. He stressed the importance of collegial sharing and of teachers being empowered to decide what is and is not "good" mathematics. Key to the Mathematics Curriculum and Teaching Program is the recognition that teachers must implement curricular reforms; in keeping with this recognition, ideas must be clearly applicable to a broad spectrum of learning environments and teaching styles before they are formally adopted by the program. The program was well received by the audience; comments are included in the site reports.

"Making quality mathematics accessible to all students" was the topic of discussion at the UMC working session held 5-7 p.m. Friday. Nearly 90 people listened to a panel of three educators--Brenda Brown (a Philadelphia teacher), Bettye Clare Lynn (a Memphis teacher), and Louvinia Wallace (the New Orleans mathematics supervisor)--talk about alternative approaches to drawing all students into mathematics education. Ms. Wallace began by illustrating her philosophy using the equation $E = me^2$ [equity = (mindset) (effort) (enthusiasm)]. To obtain equity, beliefs, attitudes and prejudices need to be changed through efforts to create opportunities for interaction and sharing of ideas. Brenda Brown drew upon her own experiences as an at-risk student and stressed that teachers must assume responsibility for reaching out to their students. She noted that innovative incentive programs and approaches that stress the excitement and fun of learning are all effective alternatives to lecturing. Bettye Claire Lynn shared some strategies she used to help motivate at-risk students and increase their interest in mathematics. Some of her techniques included awards for students' mathematics achievements, mathematics sweaters with the Mu Alpha Theta symbol, and t-shirts for A students so that other students can see who is achieving in mathematics. Students want visible rewards and need someone who cares, she said. Her strategies have resulted in higher student enrollments and renewed teacher interest; trigonometry since 1986 has increased from 15 to 45 students and calculus has increased from 4-17 during the same time period.

At the conclusion of the panelists' presentations, the discussion was opened to the audience. Uri Treisman noted that there is an assumption that parent involvement is a good thing, but when good things happened to kids, parent involvement will follow. Some teachers expressed the need for corporate help, community recognition and media attention. The group's attention then was directed inward by an emotional plea from Frank Holmes, one of the two coordinators of the San Diego collaborative, emphasizing the severity of the problem and the need for the personal involvement of every teacher. He closed by encouraging teachers to take the lead, asking them, "How can we (the UMC project) help you to help those students?" His comments generated mixed responses. One coordinator suggested that teachers have internalized the problem, but still need concrete examples of programs that are effective in helping at-risk students. On teacher said the final discussion had been discouraging and was an unfortunate way to end an otherwise inspiring conference. In his closing remarks, Mark Driscoll attempted to cast the meeting in a more positive light, suggesting that Dr. Holmes' comments were a recognition of the group's power to achieve reform.

In addition to the event's three general sessions, EDC conducted a coordinators' breakfast meeting from 7-9 a.m. Friday at the Park Suites Hotel. Nineteen people attended the meeting, including representatives from nine of the collaboratives (both Nancy Gates and Anne White from Memphis attended), six from EDC including a photographer, and three members of the Documentation Project. San Diego and Pittsburgh were the only sites not represented. The meeting was chaired by Ms. Nancy Gates, the coordinator of the Memphis collaborative. Grace Kelemanik of the Technical Assistance Project took minutes. Jean Childs-Moore was to bring to this meeting a draft of a position statement that the coordinators could discuss, but she resigned her position as a coordinator of the San Diego collaborative just prior to the meeting and did not come to Orlando.

The meeting opened with Charniece Buford, the coordinator from Cleveland, noting that she had received only two position descriptions from coordinators. At the New Orleans meeting, she had been assigned the task of preparing a document to describe coordinators' roles and responsibilities. The rest of the meeting centered on discussion of three general topics: teacher leadership, curriculum change, and equity. EDC reported on its plans for the summer teacher leadership conference and expressed the hope that participants would come to the meeting prepared to discuss a problem they were facing; these would serve as the focus of an action plan to be developed during the week. The meeting then turned to the issue of teacher leadership. This was mixed with discussions on cooperative learning and reform, including the school restructuring that some of the collaborative are experiencing. The group brainstormed ways of attracting new teachers to the profession, including restructuring time, teacher/resource director, and school-site demonstrations.

One coordinator characterized the group as a powerful source of collegial support and change. She suggested that the group's momentum is waning, however, and that members' failure to submit position descriptions may have been indicative of a need to recommit themselves to their goals. In response to the discussion, the group directed the three coordinators who serve on the Standing Committee to draft a statement on equity so that others could respond to it.

**UMC Standing Committee**

The UMC Standing Committee was established by EDC to provide a forum for the discussion of issues of mutual interest to the collaborative and to work toward building common solutions to collaborative concerns. The collaborative directors' meeting in Boston in February, 1989, was the impetus for the committee's formation; Dr. Driscoll envisioned it as a means to harness the high level of commitment demonstrated at the directors' meeting as well as a way to address the concerns that the group had raised. Committee members were selected by EDC and include Toby Bornstein (project coordinator, Los Angeles); Peggy Funkhouser (project director, Los Angeles); Nancy Gates (project coordinator, Memphis); Frank Holmes (project coordinator, San Diego); Harvey Keynes (project director, Twin Cities); Leslie Salmon-Cox (project director, Pittsburgh); and Kimberly Sawyer (project director, New Orleans).

The first meeting of the UMC Standing Committee was held May 21, 1989, at the Peabody Hotel in Memphis, Tennessee. In addition to the seven members of the committee, the meeting was also attended by staff of the UMC Technical Assistance, Outreach and Documentation projects. Topics included how the collaboratives relate to one another as components of the project as a whole; the structure that would best facilitate the group's efforts to become a national voice on educational issues; equity; and the UMC annual meeting to be held in Los Angeles. No real consensus was reached by the group in its discussion of the relationship among collaboratives; participants suggested that while the group functioned as a confederation, each of the sites focused primarily on local collaborative issues and concerns. The group determined a three-level approach to the issue of equity for the UMC: First, teachers who attend the teacher leadership conference will be asked to bring with them a statement on equity from their collaborative. Each site agreed to gather as much relevant information from their local school district(s) as time allowed to contribute to that statement. Second, the UMC project coordinators also agreed to draft a position statement on equity and finally, it was agreed that EDC would compile a notebook of successful equity strategies that collaborative teachers and schools are using in their classrooms and districts.

The day's final agenda item addressed the fourth UMC annual meeting. The conference theme, "Everybody Counts: Strategies that Work," will focus on the issue of equity. Speakers will include educators who have developed and employed strategies that have been successful in the promotion of equity. Jaime Escalante, a high school mathematics teacher whose efforts to motivate his students were documented in the movie

"Stand and Deliver," will be asked to address the conference. In keeping with this theme and to help generate discussion, Toby Bornstein will arrange for conference participants to visit schools and observe Los Angeles collaborative teachers in their classrooms. A date for the next Standing Committee meeting was not set, but it was anticipated that the group would meet more than once during the year.

### Communication Network

Common Ground, the electronic network operated by EDC, maintained a high level of activity during the 1988-89 school year. More than 3,000 messages were logged in during the 12-month period, a slightly higher number than in the previous year. The system manager, Grace Kelemanik, monitored the network and periodically cleared the database of messages when the number pushed the limits of its storage capacity. Seven forums were available to facilitate open conversations, in addition to one-to-one communications and restricted groups, such as the coordinators' group. Six of the forums had been established in 1987-88--curriculum resources and information ("Resources"), calculators and computers in the classroom ("Edutech"), notices of general interest to the network ("Notices"), collaborative governance ("Govern"), Geometric Supposer Users Group ("Geometry"), and permanence/continuation of the collaborative projects ("Perm"). A seventh forum, algebra/function analyzer ("Algebra"), was added in March, 1988. Four of the forums have moderators who work to prompt user interaction. The various forums accounted for less than a third of the total number of messages, however, with most of the communication throughout the year occurring between individuals.

The most active forum, Geometry, transmitted more than 150 messages. Twelve people submitted at least one message each, with four people contributing 90 percent of the total. Of the four most active network participants, one was the moderator, one was a teacher from the Boston area involved in field testing the Geometric Supposer, and two were teachers in Philadelphia. Three teachers from California occasionally sent messages. The moderator actively prodded people to become engaged in the forum. She submitted over a third of the messages, including proposing questions, providing some of her own work, or commenting on someone else's message: "I'd like to think out loud for a minute and perhaps encourage some responses..." or "Thanks, Tom, for the description of networking. Is it possible to give me a ballpark figure of the cost of networking a lab of Apples???" In addition to content issues, a variety of topics evolved out of these general conversations, including tests, differentiation in instruction for students with differing levels of knowledge, the use of textbooks, integrated curriculum, and technical questions about equipment and software.

The Geometry forum participants' activities exceeded their communications across the electronic medium, with several trying to meet at the NCTM annual meeting in Orlando. In addition, on June 22, 1989, the moderator and two other active forum participants gave a presentation at the National Educational Computing Conference held in Boston. They talked about their experience with the Geometric Supposer and with the electronic network.

The other forums were not as active. The Permanence forum was dormant from February 1988 until December, 1988. In December, moderator Toby Bornstein threw out the question, "Is it time to deactivate the Permanence forum?" This provoked some activity as people reported activities at individual sites and problems associated with fundraising, but the forum became quiet again in mid-February. The Governance forum experienced no activity during 1988-89. The Education Technology forum had only a few messages. The Notice forum was active with people providing information on available grants, conferences, and programs; change in administrators of the collaborative; and details for attending events sponsored by EDC.

The seventh forum, Algebra, was established in March by its moderator June Mark, a member of EDC's staff. Forum participants included the moderator, two teachers from Massachusetts, the two Philadelphia teachers who were also active on the Geometry forum, one California teacher, and Grace Kelemanik. Messages included an explanation of circle expressions, a discussion of use of the Function Analyzer, and a description of using other software. The number of messages in the Algebra forum from its initiation through June totaled fewer than 20. The Coordinators' Group had fewer than ten messages; topics included guidelines on equity, decision making, communication, instructional goals, leadership, and EDC's plans for the project to develop a UMC position paper on equity.

Participants in the electronic network appear to value the opportunities that Common Ground provides for quick and efficient communication, as well as for sharing ideas and solving problems. One collaborative coordinator commented, "Common Ground has provided me with collegial support for grappling with issues of concern. When we were grappling with the ineffectiveness of our governing structure, the 'Govern' forum provided me with helpful feedback from my colleagues in most of the other cities . . . .

[Our district] is currently considering adoption of a ninth-grade course similar to California's Math A, and it was extremely valuable for me to be able to ask my California colleagues about that course--particularly because I learned from them who the target population was in California and that target is not the same population as that intended here." A teacher from Philadelphia commented, "Common Ground has been great. During the busy workday you don't often get a chance to exchange ideas with your colleagues. With Common Ground, I get to talk with other teachers using the Supposer in their geometry classes. Their thoughts and ideas energize me. Sometimes when you're not sure you're on the right track, just knowing that one other person out there is on your track, provides the confidence necessary to continue and expand." A teacher from Los Angeles noted, "I have found the sharing of ideas and information via Common Ground very exciting . . . . It has made my work seem more important. It has made teaching more fun." Not all UMC collaboratives participated in Common Ground, which was a source of frustration to some users. One collaborative coordinator remarked, "Common Ground is vitally important to maintaining a national collaborative . . . sounds obvious, but the opportunity to simply keep up with what is happening in other collaboratives is valuable to me. I don't think one appreciates the power of instant communication until they use the network. My concern is that so few people are using it . . . ."

## Support of Professional Experiences

Relative to previous years, the Technical Assistant Project devoted fewer of its resources during 1988-89 to providing individuals with professional experiences. Instead, the TAP allocated more funds to sponsor the annual meetings, as the well as separate meetings for directors, coordinators and mathematics supervisors. The TAP still worked to provide professional opportunities to some collaborative members. As noted earlier, TAP sponsored two teachers, one from Los Angeles and one from Philadelphia, to make a presentation with Grace Kelemanik on the Geometric Network at the June 22, 1989 meeting of the Education Computing Conference in Boston. The TAP also paid expenses for two Philadelphia teachers, one who went to Dayton and one who went to Memphis, to lead staff development workshops on the Geometric Supposer. TAP also helped defray the cost of a Woodrow Wilson summer institute at eight of the UMC sites. Finally, TAP sponsored Arthur Powell's travel to New Orleans to work with teachers there.

## Outreach Project

The Outreach Project continued to evolve in its second year of operations. The project, with a staff of four--Director Brian Lord, Associate Director Janet Daisley, Research Assistant Melissa Fox, and part-time Administrative Assistant Sheila Flood--addressed the issues of linking the UMC network with the larger educational community and replicating the collaborative model in other sites. Funded in August, 1987, the project's goals were to: 1) support and inform the work of the existing collaboratives; 2) enable other communities to replicate or adapt important features of the UMC model; and 3) inform and influence the education policymaking community in its efforts to promote teacher professionalism and locally based educational change.

In its proposal to the Ford Foundation for its second year of funding, the Outreach Project detailed three themes that were to guide its work. One theme centered around collaborative networking, with an eye toward the identification of opportunities to expand and sustain the network as a means of helping teachers renew their sense of professional involvement. A second theme was the role teachers play as both designers and critics of mathematics reform. A third theme involved addressing structural obstacles to teachers' professional growth and change. Drawing on these three themes, the Outreach Project has developed a new perspective on teacher professionalism and will share this perspective more widely with educators and policymakers. The project has begun to initiate forums in which teachers and other collaborative participants address the issues of structural change in education; developed print and visual media products that highlight the connection between collaboration, networking activities, and professional development; and developed plans to assist communities in promoting teacher professionalism through collaboration and teacher networks.

### Support of Existing Collaborative

The Outreach Project engaged in a number of activities in support of the existing collaboratives and the UMC national network. During the second semester of 1987-88, EDC sent video crews to several collaborative cities to shoot an informational videotape on the UMC project. At the 1988 UMC annual meeting in Philadelphia, the videotape, Leadership and Learning, was premiered. The videotape provides a broad picture of collaborative activities and of the vision of teacher professionalism fostered by interactions between teachers and other collaborative partners. It includes interviews with several collaborative directors and teachers, as well as footage of UMC meetings held at the NCTM annual meeting in Chicago, a +PLUS+ workshop in Los Angeles, the Exploratorium Institute in San Francisco, and a site visit to a business in Cleveland. Copies of Leadership and Learning were distributed to all of the collaboratives and UMC support projects. The Outreach Project staff also presented the videotape at conferences and professional meetings as a supplement to written UMC materials, and as background information for sites considering UMC replication.

The newsletter, umc<ANGLES>, published three times in the 1988-89 school year, is another form of support provided to the collaboratives. Each issue of the newsletter addresses a theme related to collaborative activities or objectives. In addition to lead articles devoted to these themes, regular features included "One Teacher's Answer," "Collaborative Highlights," "Common Ground Update," and reports on UMC meetings. The September 1988 issue focused on "reform in mathematics education," the February 1989 issue addressed "teacher leadership," and the September 1989 issue was devoted to "equity." The newsletter is intended to be a tool for enhancing communication across the collaboratives and a forum for disseminating UMC views throughout the wider education community.

Press releases were prepared by Outreach Project staff to help individual sites increase local media coverage within their communities. Press materials were prepared for the Philadelphia Mathematics, Science and Technology Conference in September, 1988; the conference, "Mathematics for the 1990's," in Memphis, in March, 1989; the St. Louis Mathematics Contest in April, 1989; and the release of the NCTM Curriculum and Evaluation Standards in March, 1989. Although media response to these outreach efforts was limited, there were some small successes. The Los Angeles collaborative received approximately two minutes of air time on local television station KNBC, and an article on the Standards appeared in the Philadelphia Daily News as a result of the Outreach Project's press releases.

In addition to press releases, the Outreach Project created a press kit to garner public attention for new collaboratives and for the UMC national network. Included in the press kit were a short press release outlining the general structure, activities and goals of the collaborative; a brief description of the 11 collaboratives and collaborative affiliates; and short descriptions of the UMC support projects. To increase public recognition and to define issues related to the teaching profession, staff from the Outreach Project published articles in the American Mathematics Project newsletter AMPLine and in the Partnerships in Education Journal. In addition, Brian Lord, the Director of the Outreach Project, wrote papers for the Teacher Networks Group, including "The Teaching Profession: Premise and Policy," "Staff Development: Growth and Renewal in the Teaching Profession," and "Evaluating Teacher Networks."

### Replication

A major effort of the Outreach Project during 1988-89 involved promoting replication of the UMC model. Outreach staff met with representatives from prospective collaboratives and made site visits to several cities, including Dayton, Ohio; Hartford, Connecticut; and Indianapolis, Indiana. In May, a Request for Proposal for replication grants of up to $8,000 was released. The RFP was widely distributed in the mathematics education community. By the closing date of June 15, 1989, five proposals had been received. Three grants were subsequently awarded to agencies in Dayton, Ohio; Columbus, Georgia; and Milwaukee, Wisconsin. The grants included provisions for access to the UMC national network and support projects, a replication tutorial funded by the Outreach Project, and involvement in UMC teacher leadership activities.

A handbook and a resource guide designed to instruct new sites about starting a collaborative were commissioned by the Outreach Project. Both documents are to be a descriptive and documentary history of the UMC project and to provide a practical tool for communities interested in starting a mathematics collaborative. Dr. Ilene Kantrov was hired to develop the guide in close consultation with staff from the Outreach Project. In the winter, drafts of the guide were sent to the collaboratives and to the support projects for review and comments. At the end of the school year, the guide was still in draft form.

### Networking

Central to the Outreach Project's mission is the development of links between the UMC project and education policy groups, research centers, and philanthropic agencies. Targeted organizations include the Mathematical Sciences Education Board (MSEB), NCTM, the American Mathematics Project, The Council on Foundations, AERA, the Triangle Coalition, the Center for the Study of Teachers and Teaching in the Secondary Context, the Center for Educational Leadership (Vanderbilt), and representatives of other foundations (Pew Charitable Trusts, Lilly Endowment, NSF, Carnegie Corporation, and the Rockefeller Foundation). Efforts in this area are ongoing. In conjunction with the Technical Assistance Project, the Outreach Project has facilitated networking among the 11 existing collaboratives by sponsoring separate meetings for the directors and coordinators of the collaborative projects, as well as for the district mathematics supervisors.

A key component of the Outreach Project's agenda has been the development of ties to the newly formed Teacher Networks Group (TNG). TNG is an organization of the funders and operators of teacher network projects and is supported by grants from several foundations and philanthropic agencies, including the Ford Foundation, Carnegie Corporation of New York and the National Science Foundation. The group's objectives are to: 1) address policy issues related to teachers' professional development and school structure; and 2) address operational issues, such as technical assistance, evaluation, and project permanence. The June, 1988 TNG policy seminar addressed issues of school restructuring while the workshop explored the issue of technical assistance for teacher networks. The December, 1988 meetings focused on teacher professionalism and the evaluation of teacher networks. The director of the Outreach Project is also the director of the Teacher Networks Group project at EDC and has successfully placed representatives of the UMC project in central roles at each of the TNG meetings.

As a result of the concerted efforts of the staff of the Outreach Project and the TAP, the UMC Teacher Leadership Conference will be held in August, 1989, in Newton, Massachusetts. The institute will provide leadership training for approximately 30 to 40 UMC teachers, as well as teachers from recently created collaboratives. The focus of the workshop will be the role of the teacher as leader and innovator. Other issues that will be raised during the week are school restructuring, equity, and state policy concerns related to mathematics and education reform.
EDC will sponsor the attendance of two teachers from each collaborative; each collaborative will be offered the option of sending two additional teachers at the collaborative's expense.

## Documentation Project

The Documentation Project continued to collect and synthesize data and information on the UMC project during 1988-89. Site data included monthly reports and teacher interviews from the on-site observers, a mathematics conception questionnaire distributed to mathematics teachers at each site, and 27 site visits by Documentation Project staff. In addition to completing the monthly reports, the on-site observers were asked to interview five different teachers in each of four months--September, October, March, and April. In the fall, the questions related to the impact of the collaboratives on their role as a teacher; on participation in professional conferences; on forming relationships with other mathematics teachers and those in business and higher education; on changes in students' attitudes towards mathematics; on their awareness of current trends in mathematics education; and on other significant changes. In the spring, the teachers were asked about their conception of mathematics, including their definition of it; how the collaborative has affected their conception of mathematics and goals for teaching; their expectations for students regarding mathematics instruction; recommendations for improving the mathematics curriculum; and key issues surrounding mathematics education in their districts. Additional questions asked about influences on their teaching of mathematics; the main purpose for high school; the assignment of students to high school mathematics courses; and equity in mathematics education. The on-site observers met as a group twice during the year, once at the UMC annual meeting in Philadelphia and again at the NCTM annual meeting in Orlando. At these times, the procedures for collecting data, the format of the monthly reports, the development of the interview questions to address the issues of teacher leadership and collaborative impact, and other topics were discussed. As a result of the on-site observers' meeting during NCTM, two additions were made to the Monthly Report Form. The category "Permanence" was added to the Additional Comments section and a fifth section, "Impact of the Collaborative" was added to the report form.

The 1987-88 UMC Annual Report (Webb, Pittelman, Romberg, Pitman, Fadell, and Middleton, 1989), was published in March, 1989. In October, 1988, a draft of the teacher background questionnaire was distributed at the UMC annual meeting in Philadelphia for comments. Following the conference, additional surveys were returned to the Documentation Project; surveys from 430 teachers were included in the final analyses. Feedback on the report from the collaborative sites was incorporated into the report, and preparation of the technical report continued through the summer in anticipation of the October, 1989 publication date.

Twenty-seven site visits were conducted during 1988-89 by members of the Documentation Project. Site visits typically involved classroom observations, conversations with teachers, and interviews with district mathematics specialists and district administrators. An effort was made to schedule site visits to coincide with collaborative activities so that the documenter could attend a special project event.

During the year, documenters attended several board meetings, workshops, and presentations, and met with associates from business and higher education. One site visit to each collaborative was devoted to reviewing a draft of the site's annual report with the collaborative director or coordinator as a means of validating the information included in the report. In addition to their site visits, documenters attended special functions related to the UMC project, including the UMC work sessions at the NCTM annual meeting; a variety of meetings of the directors, coordinators, and mathematics specialists; and the UMC Steering Committee meeting. After each site visit and most activities, the documenters prepared notes that described the activity and his or her reactions to it.

Each year, a major effort is expended in writing the UMC project's annual report to the Ford Foundation. Preparation for the 1987-88 UMC annual report began in July, 1988, and continued through the publication of the report in March, 1989. The process included synthesizing the information from all of the sources that has been entered into the data base, writing the summary reports, sharing these reports with the collaborative leaders, and modifying them in response to each site's perceptions and input. After extensive revision and, in some cases, repeated interactions with the collaborative, a final version of the report was prepared and then shared with the sites. Concurrently, the substantive evaluative part of the report is written, reviewed by all of the members of the Documentation Staff, and finalized. Nearly 200 copies of the report are distributed.

## Case Study Component

A case study component of the Documentation Project was initiated in December, 1987, under the direction of Professor Thomas Popkewitz of the University of Wisconsin-Madison. This project was designed to conduct case studies of one or two teachers at each of the 11 collaboratives, six during 1987-88 and five during 1988-89. The completed set of case studies, which will be presented in a final report in 1990, will focus on a variety of teachers, all of whose professional lives have been affected by the UMC project. The extent to which the individual teachers have availed themselves of the opportunities and programs offered by the collaborative has varied both by individual and by site, but overall, most case study subjects were active participants in their local projects.

During 1988-89, Professor Popkewitz, assisted by Project Assistant Sigurjon Myrdal, identified an on-site enthnographer for each of the five collaboratives to be included in the second round of case studies: Durham, Memphis, New Orleans, Philadelphia, and San

Diego. The methods and procedures for conducting the case studies were discussed with the ethnographers and with the collaborative administrators. Also included in the discussion was how the case study approach fit into the overall documentation effort. Meetings with the collaborative staffs were held to discuss which teachers would be potential candidates for the study.

Flexible guidelines directed the researchers' selection of teachers for the case studies. Typically, the collaborative director and staff at each site provided the ethnographers with information about a core group of active teachers. Ethnographers then attended several collaborative events in order to gather background information and to meet the teachers. Based on these visits, and in light of the advice of the collaborative staff, the ethnographers identified one or two teachers to be the subjects of the case study reports. In gathering the information for the case studies, the ethnographer interviewed each teacher on several occasions and also observed the teachers extensively at school as well as in other professional contexts.

During the selection, research, and writing phases of the case studies, the ethnographers remained in constant communication with the staff of the Documentation Project. In April, 1989, several of the ethnographers met at the American Educational Research Association's annual meeting in San Francisco, and all of the ethnographers and case study component staff met for three days in Madison in May. In addition, some of the ethnographers were enrolled on Common Ground and thus were linked electronically with the Documentation Project staff.

Drafts of the first six case studies had been completed in June, 1988, and drafts of the second five case studies will be completed by September, 1989. Two kinds of information are presented. The first describes the professional lives, interactions, and thoughts of these teachers as they work in the classroom, the relationship of their daily activities and their views of the collaborative, and the changes they perceive to have occurred as a result of their collaborative involvement. The case studies describe the collaborative's effect on teacher's everyday lives in schools and in classrooms, on their successes and frustrations, and on the tensions of the reform process itself. The second aspect of the study discusses the teachers' conceptions of mathematics and the teaching of mathematics, and the assumptions and implications that can be drawn from their pedagogical reasoning.

## Reflections

During 1988-89, EDC assumed more responsibility for the management of the UMC project. As a result of this transition, the delineation between the Technical Assistance Project and the Outreach Project became blurred as staff from both projects continued to assist individual sites and to assume responsibility for the overall management of the UMC project. EDC's support and services appeared to be a critical component of the project's ongoing growth and development. Because of constant pressure from EDC and a continual emphasis on reform, equity, and teacher leadership, the individual collaboratives began to view themselves as members of a larger network that could accomplish larger goals. Skepticism remains, however, among some observers who say that no collaborative has a firm enough management structure to assume that any one person speaks for the site as a whole. The question remains as to whether the UMC project has a common voice and, if so, how it can be expressed. This year, the sites did attend to some common issues. This is important to note for a couple of reasons. First, through EDC's efforts to achieve a common focus for the UMC project, many collaborative became sensitized to the issues raised by EDC and began to address them at the local level. As in previous years, this process and its outcome support the value of a network of sites assisted by an organization charged with managing the network. Second, the sites themselves have evolved this year to a state in which the basic needs of finance and organization are not as critical, so that time and energy can be devoted to issues other than survival. This means that less of the Technical Assistance Project's time is needed in assisting with managerial issues and more of EDC's efforts, as well as the efforts of the sites, can be spent on substantive issues.

# IV. OBSERVATIONS AND REFLECTIONS

Each site report includes detailed reflections on four major topics: project management, collaboration, professionalism, and mathematics focus. All of the previous annual reports also include extensive sections of observations and reflections, each of which examines the issues that have emerged throughout the development of the collaboratives. This section targets particular issues that have arisen during the 1988-89 school year; in most cases, they are associated with the processes and organizational structures the collaboratives have established in their work toward permanence.

The potential impact of the Urban Mathematics Collaboratives project on teachers in the nation's urban schools is staggering. Sheer numbers suggest the depth of this impact: in 1988-89, 572 teachers considered themselves active or frequent collaborative participants (as measured by Documentation Project questionnaires); this accounts for approximately 19 percent of the more than 3,000 high school mathematics teachers employed by target districts. If one estimates that each of these 572 participants teaches 100 different students over the course of a school year--and if one applies a correction of .5 to account for teachers in the same schools teaching the same students--the number of students directly affected by the collaborative totals approximately 285,000. This represents more than 15 percent of the total number of students enrolled in the targeted districts, and more than 70 percent of the high school students in targeted schools. It should also be noted that these figures represent only those teachers who identify themselves as frequent collaborative participants, a fraction of the total number of teachers that the urban mathematics collaboratives influence each year through small grants, workshops and other professional, enrichment activities.

## Project Management

Project management at each of the 11 collaboratives has evolved over the year in response to the site's efforts toward permanence. Some collaboratives have redefined their entire management structure, while others have assigned new people to key positions in the collaborative. Only Pittsburgh continued with the management structure and personnel it had established during 1988-89. But even in Pittsburgh, a new Liaison Committee was established to foster closer links between collaborative teachers and the programs designed to address their needs.

Changes in management personnel and structure have characterized the collaboratives from their inception. Seven of the 11 collaboratives have brought in new coordinators since their first year. Four of them have a different director. The nature of collaboration in general is one reason for this fluctuation in personnel. Collaboratives are low-budget organizations that have depended to a great degree on part-time help. Often, a well-qualified individual who is interested in the position is eager to split the workload with a colleague, or to assume responsibility for the position while they continue to pursue employment elsewhere as well. As a result, collaborative administrators have on occasion worked long hours for little or no reimbursement. Most of the collaboratives have weathered these changes, an important indication of the willingness of project participants and host agencies to make the collaborative project a viable, workable program.

Four of the collaboratives--Los Angeles, Philadelphia, San Francisco, and Twin Cities--experienced significant structural changes during 1988-89 as they worked to create a structure for permanence. Motivation for these changes varied by site. In Los Angeles, it was the intent to train the teacher coordinator to lead a satellite Teachers' Council of six to eight schools as a strategy to expand the +PLUS+ program throughout the urban area. In Philadelphia, the coordinator was "shadowed" by a PRISM representative as a step toward transferring responsibility for the collaborative from the Franklin Institute to PRISM. PRISM's mission of supporting the Philadelphia schools through teacher development programs aligned closely with the collaborative's goals, thereby providing a greater stability in funding than could be accomplished through the Franklin Institute. In San Francisco, a full-time director's position was established and the former advisory committees were reconstituted into the Steering Committee. It was hoped that these adjustments would enhance the efficiency and effectiveness of the collaborative management in order to increase teachers' power and control. The Twin Cities collaborative created a governing board to serve as its decision-making body; this group replaced a committee that served as an advisor to the director rather than as the ultimate decision maker. This reorganization helped to position the collaborative to gain nonprofit status and become independent of its host agency, the University of Minnesota.

The restructuring process was motivated primarily by the goals and individual work patterns of each site. Its broad success, however, suggests that the collaboratives have come to understand their own strengths and weaknesses and are willing to adjust leadership roles accordingly. Important to collaboration has been a host agency that can provide stability in the collaborative's formative stage, as well as some resiliency to the inevitable changes in program and goals that typically occur as a project evolves.

A related issue is the definition of the role of coordinator. The responsibilities of the coordinator's position have been unique to each site, but in all cases they have combined some variety of the following routine functions: administrative details of arranging events, promoting attendance, and responding to inquiries; program planning, including coordinating participants, assessing program needs, and evaluating whether the program meets collaborative goals and purposes; and goal setting, which establishes the project's direction and provides an overview of its current and future agendas.

In nearly half of the collaboratives, a current or former teacher serves as project coordinator. In most collaboratives, the coordinator spends a significant amount of time working with teachers to develop the program. In some sites, such as Los Angeles and Durham, the coordinator also undertakes some of the responsibilities that are typically assumed by the director. In contrast, two of the collaboratives, Cleveland and Twin Cities, define the coordinator's role as administrative rather than integral and hire applicants who are not teachers to fill the position. The broad range of coordinators' duties has caused some difficulties in identifying individuals who are willing to do all that is required. Some collaboratives have resolved this issue by channeling many of the administrative details to a capable office staff. If teachers are to assume leadership roles, it seems essential to provide some clerical support, especially because of their lack of access to such services in the schools. Having someone on staff who can answer questions about the collaborative and who is consistently accessible has proven on occasion to be critical to the efficient functioning of the collaborative.

The coordinators discussed their job responsibilities at their meeting in New Orleans on February 11, 1989. It became clear that the coordinator was viewed as the single most pivotal position in the collaborative administration. While job responsibilities varied by site, in all cases, the coordinator's role was determined by its relationships to the school district, host agency, and other prominent community organizations. Meeting participants observed that the position would need to be changed as the collaboratives evolved. One coordinator reported that her responsibilities included developing leadership opportunities for teachers that would complement their teaching without removing them from the classroom. Another coordinator stressed that the position depended upon the formation of professional relationships. Some coordinators suggested that they served as a liaison between the collaborative and a wide variety of organizations. Since the collaboratives are funded through agencies independent of the school district, the coordinator must be able to work independently while understanding district operations well enough to work within the system when necessary.

Fund raising was not an issue during 1988-89. All of the collaboratives were able to acquire the necessary funding to maintain their operations. Two collaboratives not funded through education funds, Twin Cities and Durham, did expend some effort to raise money, but these were not considered appropriate roles for either of the managing agencies. Despite this, both sites eventually raised the targeted funds. In Durham, the Advisory Board spent a considerable amount of time fund raising. In Twin Cities, responsibility for fund raising was assumed largely by the director and coordinator. It is expected that fund raising will become more of an issue as the collaboratives seek permanence. In particular, sites not hosted by agencies accustomed to fund raising are increasingly concerned about generating sufficient financial support to sustain activities in the face of waning Ford Foundation funding.

The permanence proposal process has resulted in a new level of interaction between the UMC network resources and some of the sites. In many cases, the Ford Foundation and EDC have required individual sites to provide further clarification in their permanence proposals; often, these revisions have provided greater specificity on the strategies needed to reach the visions articulated in the proposals. The Ford Foundation requested that three of the sites work with EDC to undertake a major rewriting of their proposals. As a result, EDC assumed an interventionist role that exceeded its traditional strategy of providing technical assistance upon request. In these instances, EDC engaged an on-site consultant to facilitate the process of bringing groups of people together to plan for the future of the collaborative. It was the role of the on-site consultant to help identify community representatives who could bring various levels of expertise to the process, to bring these people together with collaborative participants, and to guide group discussions to generate consensus about what needed to be done. The collaborative was then responsible for preparing the revised proposal. The process was completed successfully in San Francisco during the fall, 1988, with Dr. Phil Daro, California Mathematics Project, as the facilitator. Dr. Daro, along with the active involvement of representatives of EDC, helped orchestrate planning meetings that sometimes exceeded 50 people. Plans were made to restructure the collaborative to include elementary teachers and to establish teachers as the key decision-making authority. The revised proposal was approved by the Ford Foundation in January, 1989. As this report is being produced, San Diego and St. Louis are engaged in similar processes.

### Collaboration

As a result of their collaborative involvement, teachers have established new avenues of collegiality--among their peers, with those in business, with those in higher education, and with the school district administration. Collaboration among teachers has included fostering departmental planning; in-school networking between mathematics and science teachers; department team building; departmental grants; establishing representative committees across schools; and developing collaboration through working on a common task, such as a mathematics fair or contest. Collaboration involving teachers and those from other sectors include participating in internships, serving on the Advisory Board, making site visits, forming a mathematics education advocacy group, and making presentations at professional meetings.

The site reports are full of rich examples describing these interactions. In 1988-89, very few new forms of collaboration were initiated; instead, efforts were exerted to maintain existing forms and to expand upon those forms of collaboration that seemed to be the most beneficial. The previous annual report (Webb, Pittelman, Romberg, Pitman, Fadell, & Middleton, 1989) describes in some detail the delineation of collaboration within schools, across schools, across sites, and across sectors. The critical issue faced in this fourth year of the UMC project was sustaining collaboration, a more difficult task across sectors than among individual teachers themselves.

The most important form of collaboration resulting from the UMC project has been the development of collegiality among teachers, within and across sites. In all collaboratives, teachers emphasize the difference that the project has made in enhancing their interactions with their colleagues in their own schools, in their districts, and with teachers in other cities. Teachers' councils and advisory groups, established through the collaborative, were slow in starting but are now maturing and assuming more leadership and initiative. This is evident, for example, with Cleveland's Teacher Advisory Board, Los Angeles' Teachers' Council, Philadelphia's Teacher Leadership Planning Group, Pittsburgh's Instructional Teacher Leaders Group, and Twin Cities' Building Representatives. Other collaboratives have had consistently active teacher groups, as is the case in Durham and St. Louis, or have initiated groups that are still under development, such as Memphis and San Francisco. In San Diego, at the end of the year, a teacher committee was formed to plan for permanence. This was in addition to the Executive Committee, which actively includes teachers with those from higher education and the school district.

Most of the collaboratives have developed and maintained activities specifically geared to engage teachers with those from business and higher education. Some of the more costly activities in several collaboratives have been reduced or eliminated because of the limited availability of funds or because of shifting priorities. The permanence process also consumed much of the projects' available energy; as a result, for example, the Exploratorium summer institutes in San Francisco were not held because of the major effort that was spent on planning for permanence. In some cases, business representatives who serve on collaborative advisory boards have questioned whether they are making a contribution. In response to this concern, the Cleveland collaborative formed an Advocacy Committee of business and higher education board members to plan activities or projects that will enable them to be advocates for the mathematics education in the community. This was but one of many examples of the collaborative's efforts to engage representatives of business and higher education in ways that promote their participation and continued interest.

The permanence planning process provided an occasion for some collaboratives to strengthen their relationship with the school district by negotiating its relationship to the future state of the collaborative. This process required each sector to articulate its needs and to respond to one another's concerns. As a result, some collaboratives have expanded their teacher target groups to a greater number of schools in the district or to a wider grade range of teachers. By the end of the 1988-89 school year, only the Philadelphia and St. Louis collaboratives limited membership to secondary mathematics teachers. San Francisco was the first collaborative to extend to K-12 teachers of mathematics. Part of the motivation for the expansion to a larger targeted group was the district's desire and insistence that a larger number of teachers be given the opportunities afforded by the collaborative. In other cases, program considerations motivated the change such as when the middle school mathematics program is closely linked with the secondary school mathematics program in some way.

## Professionalism

Professional enhancement is evident in all of the collaboratives. Some teachers have developed a renewed interest in their teaching, even to the extent that the collaborative has been cited as an important reason for remaining in the profession. Other teachers are assuming more leadership roles, serving on boards, presenting workshops, organizing other teachers, and engaging in strategic planning. Reference groups have expanded from a handful of teachers within the school to entire departments, other teachers from other district schools, and some teachers from other parts of the country. A teacher who is active on the Common Ground Geometry Forum identified the problem being isolated and how the national network has further communication. "Our profession causes us to be isolated. We are isolated in our rooms . . . isolated with our teaching subjects . . . and isolated with our information . . . . The use of Common Ground has brought professionals together and has opened needed channels of communication." Active collaborative teachers are assuming more responsibilities within the school district, including providing professional development for other teachers, engaging in curriculum development, and helping to develop assessment instruments. In some cases, teachers have been willing to assume some risks by initiating a new course, changing how a course is taught, or departing from some established policies.

What is not as readily apparent has been the impact of collaborative efforts to engage teachers in reflective analysis and constructive criticism. Teachers tend to be very accepting of ideas from their colleagues, especially of those that can be applied directly in the classroom. There have been few instances during the collaborative enterprise in which groups of teachers have tried ideas, discussed the outcome, made changes, and tested the ideas again until the desired outcomes are reached. The reasons for this are, in large part, situational; constraints imposed by the curriculum and lack of time for on-going interaction eliminate opportunities for extended collegial interaction. Many of the collaboratives have sponsored activities that have provided opportunities for teachers to share ideas with their colleagues, but few have constructed the activities so that teachers are able to work with one another over a period of time. One exception is the networking groups in Durham, which provide the forum in which a group of teachers meets throughout the school year to discuss course issues. Another is Los Angeles, where teachers have begun to make classroom visits to explore their colleagues' curricular approaches. These programs represent one step in teachers' efforts to become more informed about the activities of their colleagues and to share their ideas and concern. Whether these programs will continue to develop now that many of the teachers are expressing renewed interest in the profession is yet to be seen. .

## Mathematics Focus

The release of the NCTM Curriculum and Evaluation Standards in March, 1989, has been used by collaboratives as a lever to advance mathematics education in their communities. Symposia have been held, press conferences conducted, workshops presented, and curricular planning sessions offered, all centered on the Standards. This positive, proactive approach to an important development in mathematics reform suggests that the collaboratives are prepared to take advantage of all opportunities to disseminate information and innovation, and that teachers are interested and accepting of curricular change. The collaboratives have also helped to train teachers in the use of technology, making them better prepared to implement the Standards. It should be noted that teachers recognize the conflict between the need for increased problem solving, reasoning, and inquiry, and the fact that a high percentage of students are still struggling with basic computational skills. The new recommendations leave many questions unanswered that need to be addressed, particularly in terms of implementation. The collaboratives are in a position to assume a leadership role in providing solutions to concerns about issues of equity and the complexities of enacting reform. It is anticipated that the Standards will be understood and interpreted in the context of collaborative teachers' experience in large bureaucratic systems with the broad range of students endemic to inner-city schools. It is to be seen whether the collaborative teachers as a group will accept the challenge of educating the mathematics community at large by providing solid role models for implementing reform. As professionals, teachers' vast knowledge of students mathematics, and pedagogy, could transcend the barriers of bureaucratic inefficiency and educational routinization to make the inner-city mathematics classroom a showcase for academic innovation and excellence.

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# APPENDIXES

## SUMMARY REPORTS FOR THE ELEVEN URBAN MATHEMATICS COLLABORATIVES

A. Cleveland Collaborative for Mathematics Education ($C^2ME$)
B. Durham Collaborative: The Durham Mathematics Council
C. Los Angeles Urban Mathematics/Science/Technology Collaborative
D. Memphis Urban Mathematics Collaborative
E. New Orleans Mathematics Collaborative (NOMC)
F. Philadelphia Math Science Collaborative
G. Pittsburgh Mathematics Collaborative
H. St. Louis Urban Mathematics Collaborative
I. San Diego Urban Mathematics Collaborative
J. San Francisco Mathematics Collaborative
K. Twin Cities Urban Mathematics Collaborative

The following reports are brief summaries of each of the eleven urban mathematics collaboratives funded by the Ford Foundation. Although the reports were prepared by staff of the Documentation Project, the content of each report was approved by the project.

# SUMMARY REPORT:
# CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION ($C^2$ME)

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Cleveland Collaborative for Mathematics Education ($C^2$ME) during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Cleveland collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; a paper on the Problem-Solving Infusion Project by Charles Bruckerhoff (1989); monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

# CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION ($C^2ME$)

## A. Purpose

The Cleveland Collaborative for Mathematics Education is guided by a four-year work plan that covers the years from 1988 to 1992. The mission for the collaborative, as stated in the plan, is:

> To enhance the professionalism and effectiveness of intermediate and secondary school mathematics teachers by providing opportunities for collegiality, training/professional growth and curriculum development that will enable them to deliver contemporary mathematics education which enhances critical thinking skills and the use of technology and models; and
>
> To involve teachers, local business/industry, community members and parents in a shared perspective of contemporary mathematics instruction in the Cleveland Public Schools.

In support of this mission the $C^2ME$ has identified four goals:

1. To enhance the collegiality of intermediate and secondary mathematics teachers in the Cleveland Public Schools;
2. To enhance the effectiveness and efficiency of mathematics instruction;
3. To develop a contemporary mathematics curriculum that emphasizes critical thinking and the use of technology; and
4. To articulate the mathematics program to all members of the Cleveland community.

## B. Context

Cleveland, a city of 536,000 residents, is situated in a metropolitan area with a population of more than 1.8 million. The downtown business district is currently undergoing a $2 billion building boom and a renovation of historic industrial sites; it has become an attractive alternative for young professionals from around the country. In addition to the massive surge in new business, the city is also reviving its midtown residential areas and creating new art centers and parks.

The Cleveland Public Schools (CPS) district, which serves the metropolitan area, is comprised of 128 schools, including 22 intermediate schools (grades 7-8) and 12 high schools (grades 9-12). In addition, the district has nine magnet schools and one school for special populations.

During 1988-89, the CPS district enrolled approximately 72,000 students: Fifty-two percent of the student population was male and 48 percent was female. Enrollment over the past 15 years has followed a steady, sharp downward trend, from a high of 145,000 students in 1972-73 to the current low of 72,000. During the same time period, the district's ethnic mix has changed from 57 percent black and 40 percent white in 1972-73, to 70 percent black, 24 percent white, 5 percent Hispanic, and 1 percent Asian in 1987-88. Approximately 4 percent of district students have English as a second language, and 68 percent are eligible for federally funded lunch programs. Twenty-five percent of students living within the district boundaries attend private schools.

Approximately 20,000 students attend high schools in the CPS district. Of these, approximately 74 percent are black, 21 percent are white, 5 percent are Hispanic and 1 percent are Asian. There are approximately the same number of boys as girls. Forty-eight percent are eligible for federally funded lunch programs. One-third of CPS high school students, including almost half of the ninth grade population, failed a grade in 1987-88. The dropout rate for the 1988-89 school year was 11.8 percent, a slight improvement over the dropout rate of 12.1 percent for the 1987-88 school year. Minority students have a significantly higher dropout rate than white students, with 38 percent of the minority student population leaving school each year. Cumulatively, only 50 percent of CPS students are expected to graduate. Cleveland calculates the dropout rate more stringently than many school systems by including both returning students and students who are pursuing high school equivalency who drop out again.

All CPS students are required to take one unit of science and two units of mathematics. Pupils in college preparation courses typically take three units of science and three units of mathematics to meet university and college requirements. In 1987-88, 38 percent of the ninth grade students in Cleveland scored in the range considered below average in mathematical computation on the California Achievement Test, compared to the norm of 23 percent in the national sample. Fifty-seven percent of ninth graders scored in the average range, and 5 percent scored above average, compared to the norm of 54 percent and 23 percent, respectively, in the national sample.

Approximately 15,000 CPS high school students were enrolled in mathematics courses during the 1987-88 school year. Fifty-two percent of the students were male and 48 percent were female. Seventy-six percent of the mathematics students were black; the racial composition of the remaining 24 percent was unavailable. Of all mathematics students, 41 percent are in the ninth grade.

Approximately 1,300 teachers are employed by CPS high schools. Of these, 52 percent are female and 48 percent are male. Fifty-nine percent of the high school teachers are white, 40 percent are black, and 1 percent are Hispanic. All CPS high school teachers belong to an active teachers' union. In September, 1988, members of the Cleveland Teachers Union approved a two-year contract agreement that provides for a 3 percent raise beginning September 1, 1988; a 3 percent raise on January 1, 1989; and another 5 percent raise beginning in September, 1989. In addition, the union agreed to implement peer review and the voluntary career ladder. The average teacher salary for the 1988-89 school year was $30,171.

During 1987-88, the district employed 97 high school mathematics teachers, of which 68 percent are male and 32 percent are female. Seventy-three percent are white, 25 percent are black, 1 percent are Asian and 1 percent are Hispanic. All of the district's high school mathematics teachers are certified in their subject area, and 70 percent are tenured. In addition to the district's 97 high school mathematics teachers, there are 71 who teach mathematics at the intermediate level; of these, 53 percent are male, and 47 percent are female. Approximately 46 percent of the intermediate teachers are black. Seventy-two percent have secondary certification, 10 percent have elementary certification, 6 percent are certified in both, and the certification of the other 12 percent is unknown. There also are 18 teachers who teach mathematics at magnet schools. Of these, approximately 30 percent represent a minority group and 44 percent are female. The total number of mathematics teachers eligible to participate in the collaborative is approximately 200. Of these, 50 percent routinely participate in collaborative activities, and another 30 percent participate occasionally.

A new policy implemented in 1988-89 granted one additional mathematics teacher to each comprehensive high school and intermediate school to either expand the existing curriculum or to make tutoring available. The intent is to reduce failures and to give students the opportunity for enrichment. Each school had to present a plan on how it would use the additional teacher. Some schools are offering tutoring programs, others are reducing class size, still others are implementing enrichment programs. Preliminary evidence indicates that the policy is having very positive effects.

Dr. Alfred D. Tutela has been superintendent of the CPS system for more than two years. By reputation, his attributes include his attentiveness to district desegregation efforts, his insistence on school-based management, and his determination to hold teachers accountable for their effectiveness. Despite projections of a massive deficit after the 1988-89 school year, the CPS system ended the fiscal year with a $21 million budget surplus. This was due, in part, to record interest earnings of $7.8 million, a $4.8 million increase in State desegregation funding and other one-time revenue sources including large corporate back-tax payments. Despite this balance, school administrators are worried that additional costs will put the district in serious financial trouble by the 1990-91 school year. The projected budget for the 1989-90 school year is approximately $350 million.

In spring 1989, the School Board voted to extend its power to include adjusting salaries and reassigning principals and assistant principals, once the domain of Dr. Tutela. In June, almost one-third of the CPS principals attended a School Board meeting to ask members to end disharmony and to focus on education. They cited indecision over capital improvements, whether high schools should offer concentrations in certain careers, and preschool programs. The group complained that the Board's lack of decisiveness has forced principals to take up the slack.

Starting with the 1988-89 school year, principals in the CPS district will be graded on their performance on a number of educational objectives, including lowering the number of students who fail courses. This policy has led to disputes between the administration and the local teachers' union over whether it encourages principals to pressure teachers to pass undeserving students. Dr. Tutela has acknowledged that principal evaluations may lead eventually to a merit pay system.

Superintendent Tutela has been instrumental in implementing the Scholarship-in-Escrow program. This program was developed and funded by the Greater Cleveland Roundtable on his initial suggestion. The plan is designed both to act as an incentive for improving student achievement and to help defray the cost of tuition for college-bound students. Seventh through twelfth graders are awarded money in escrow contingent upon their grades in major subjects. Students receive $40 for each A, $20 for each B, and $10 for each C they earn. In addition, students enrolled in honors courses receive an additional $10 for each grade they earn above a C. The program appears to be a success. During the 1988-89 school year, 20,000 students earned over $1 million. This represents an increase of 9 percent in the amount earned since 1987-88, and an increase of 11 percent in the number of students who will receive money. Funds earned are placed into escrow accounts in each student's name. When students attend college or trade school, the money will be sent directly to their institutions.

A private family in Cleveland recently established the "I Have A Dream" program. This program, modeled after one established in New York by business entrepreneur Eugene Lang, is designed to encourage students to stay in school. The program has promised to pay the college tuition of every student in a targeted sixth grade class who is accepted to college. Mentoring is one of the key strategies employed in the program, and special arrangements have been made with the Cleveland Public schools for teachers to provide tutoring to students in this program.

In total, 175 Cleveland Public School students enrolled in Mathematics for Tomorrow, a five-week summer mathematics enrichment program sponsored by the Cleveland Public Schools. The program was designed to expose mathematically talented students in grades 5 through 8 to new topics in mathematics and new technologies in an environment rich with innovative projects and problem-solving. Mathematics for Tomorrow was staffed by C$^2$ME teachers.

Two Cleveland high schools, John Adams and John Marshall, are among the 86 high schools nationwide that are field-testing a textbook developed by the Calculator and Computer Precalculus Project (C$^2$PC) at Ohio State University. The textbook is designed to incorporate graphing calculators and computers with function software into a new pre-calculus course. Computers and graphing calculators are used to quickly produce accurate graphs of functions, conic equations, polar equations and parametric equations. Ron Brahler, the field-test teacher from Cleveland, attended a 1988 summer institute in

Columbus, Ohio, and participated in three meetings during the 1988-89 school year to learn about the materials.

Thirty-six seventh grade students in the CPS were selected by Ohio State University and the district to participate in the Young Scholars Program for the 1988-89 school year. Another 100 sixth grade students entered the program in May, 1989, for the balance of that year and for 1989-90. They were among 200 students from eight Ohio school districts chosen last spring. The program is part of Ohio State's efforts to increase the number of minority students interested in attending a four-year college or university. High school students who are successful in the program will be guaranteed admission to Ohio State with financial aid. Alternately, Ohio State will also assist any participant who wishes to enter another four-year college.

College scholarships are also available to students through the Cleveland Scholarship Program. This program finds or awards scholarships to deserving students from the Cleveland Public Schools as well as from the surrounding areas.

Several times during the 1988-89 school year, information about mathematics education, specifically how the new NCTM Standards for teaching mathematics will affect mathematics education in Cleveland Public Schools, was highlighted in local media. In November, Robert Seitz, the on-site observer for the C$^2$ME and mathematics department head at John Adams High School, and Bill Bauer, the mathematics supervisor of the CPS district, participated in a local radio show, "Cleveland Scanner," to discuss the Cleveland science and mathematics programs and how to motivate students inside the classroom. Mr. Seitz was on another radio show hosted by the governor, heard on 25 radio stations across the state, to discuss new processes in mathematics and science education. In addition, two collaborative members--a teacher and a representative of business and industry--participated in a radio program to discuss AETNA Math Clubs and an upcoming competition sponsored by the clubs. Barbara Patterson was interviewed on radio on two occasions and the Cleveland newspaper, The Plain Dealer, interviewed Mr. Bauer concerning the Standards.

Mr. Seitz was the recipient of the Presidential Award for Excellence in the Teaching of Mathematics for the state of Ohio in 1988. In October, he went to Washington to receive the award and attended a reception, a state dinner, tours, workshops and a presentation on fractals. According to Mr. Seitz, he returned to Cleveland convinced that there is an urgent need to improve the teaching and learning of mathematics in order for the United States to remain a first-class world power. He stressed that more mathematics majors are needed, including more women and minority students.

The Cleveland Education Fund (CEF), which serves as the funding agent for $C^2ME$, also supports two other collaboratives: a collaborative that focuses on the arts and humanities, and the Cleveland Science Collaborative, an organization funded by the Carnegie Foundation with goals and purpose similar to the $C^2ME$. Mr. Joe Flynn is the coordinator of the science collaborative. In addition to the three collaboratives, the CEF also supports a variety of projects designed to improve schooling in the area. Projects include Family Science Saturdays, Improving Urban Elementary Science, Gridiron Geography, the Problem-Solving Infusion Project and several grant programs. The Problem-Solving Infusion Project is designed to upgrade the CPS seventh and eighth-grade mathematics curriculum by integrating problem-solving into the classroom. As part of this effort, teachers are developing, testing, and sharing problems with their local colleagues via a computer network. The curriculum that results from the project will ultimately be distributed nationwide. The Problem-Solving Infusion Project is supported by a four-year, $400,000 grant from the National Science Foundation (NSF). Principal consultants for the grant are Dr. Rudd Crawford of Oberlin College and Dr. Richard Little of Baldwin-Wallace College. In 1988-89, 11 teachers piloted problems in their classrooms and refined them as needed.

Beginning in the 1988-89 school year, the CEF provided Small Team Enrichment Project (STEP) grants (up to $1,200) to schools for projects intended to improve academic achievement, attendance, group relations, or leadership. In addition, the Small Grants Program awards grants up to $500 to students, teachers, administrators and parents who want to develop ideas for creative learning.

The Cleveland Education Fund held its annual meeting March 16, 1989, at the University Club. The mathematics collaborative was the focus of the dinner meeting, and Dr. Uri Treisman of the University of California at Berkeley was the keynote speaker. Approximately 250 people attended the meeting, including 50 mathematics and science teachers, CEF Board members, financial contributors to CEF, curriculum leaders and the directors of the school clusters in the Cleveland Public Schools.

The Cleveland Teacher Internship Program (CTIP), established in 1980, offers CPS teachers hands-on experience with mathematics used daily in business and industry. The program establishes and coordinates summer work placement for teachers in area businesses and industrial labs. The program's objective is to provide Cleveland area teachers with opportunities for professional growth and first-hand experience in the workplace such that they can return to their classrooms well versed in the kinds of skill and knowledge their students will need in the world of work. During the summer of 1988, 16 CPS teachers worked as interns in seven local businesses; of these, five were mathematics teachers. The internships ranged from seven to ten weeks, with an average salary for the full-time positions of $4,750. In addition to working at the corporation, teachers attended six afternoon seminars over the course of the summer and prepared a learning project for their own classrooms. Teacher interns also enrolled for one to seven graduate credits at CSU in conjunction with these projects. Interns met in October to share their completed work. Eight CPS teachers have been selected to serve as 1989 summer interns through Cleveland's Teacher Internship Program. Of these, three are intermediate and five are secondary mathematics teachers. As in the previous year, there were more applicants than positions available.

In July, 1988, Oberlin College offered a teacher institute, "Project to Increase Mastery of Mathematics (PIMM)." In the morning, the teachers attended classes in Probability, Statistics, and Discrete Mathematics. The institute was designed to refresh teachers' skills and to introduce new topics in mathematics. In the afternoon, the participants listened to presentations by guest speakers who provided insights into current trends in mathematics education. Two C$^2$ME teachers, Robert Seitz and Richard Wittman, attended the institute. As a direct outcome of their participation, some innovative approaches for teaching introductory algebra classes were initiated at John Adams High School.

### C. Development of the Collaborative

As director of the Cleveland Education Fund (CEF), Barbara H. Patterson serves as director of the collaborative. In this capacity, Ms. Patterson is responsible for implementing the policies of the Advisory Board, raising funds through the Education Fund, supervising the business and financial operations of the collaborative, supervising collaborative staff and volunteers, pursuing effective relationships with community leaders and school officials, and interacting with the larger UMC network. With the expansion of other CEF programs, the director is unable to be as involved in the daily affairs of the collaborative as she had been in the past, and has come to depend upon the coordinator to assume some of the day-to-day administrative responsibilities of the collaborative.

Until her resignation in May, 1989, Charniece Buford Holmes served in the full-time position of collaborative coordinator; as such, she was responsible for the daily operations of the collaborative, including informing people of meetings, preparing financial and other reports for meetings, and making arrangements for collaborative activities. Ms. Buford Holmes also assumed the responsibility for assembling the collaborative newsletter using teacher-written articles. In April, 1989, four teachers volunteered to serve as her advisors for the newsletter. In March, 1989, Cecille Caluya was hired to assist Ms. Buford Holmes, and she continues to serve as administrative assistant for the mathematics collaborative. The coordinator's position was not filled until August, 1989, when Mr. Joe Flynn, a former acting director of CEF and the coordinator of the Science Collaborative, was appointed. Mr. Robert Seitz, the mathematics department head at John Adams High School in Cleveland, is the on-site observer.

### Advisory Board

The 39-member Advisory Board meets every second month during the school year to oversee the operation of $C^2$ME. Members of the Advisory Board include scientists, engineers, mathematicians, educators (secondary and post-secondary), and people from finance, accounting, and applied mathematics (product design and technological advancement). In addition, nine Cleveland Public Schools mathematics teachers and Mr. Bill Bauer, the district supervisor of mathematics, serve on the Board. Ms. Barbara Pence, Vice President for Branch Administration of the National City Bank, was the chairperson of the Advisory Board during the 1988-89 school year. Ms. Joie Drouhard of IBM, who was the chairperson during 1987-88, served as vice chairperson.

At the beginning of the school year, the Advisory Board had four standing committees: Teacher Advisory Board, Program Committee, Public Relations Committee, and Strategic Planning Committee. The Strategic Planning Committee engages in long-range planning and identifies and mobilizes financial resources. This committee, which had been very active in developing the permanence proposal, did not meet during 1988-89. The Program Committee works closely with the Teacher Advisory Board to develop and implement programs and to maintain the link between teachers' needs and these programs. The Teacher Advisory Board provides input to the collaborative's Advisory Board on issues of special importance to mathematics teachers, evaluates $C^2$ME programs, and makes recommendations for future programs. The Public Relations Committee publicizes $C^2$ME to the Cleveland community. Two additional committees were formed in

March, 1989: the Advocacy Committee and the Board Development Committee. The Advocacy Committee was established to plan ways in which the Advisory Board and the collaborative could play an advocacy role in promoting the NCTM Curriculum and Evaluation Standards to the Cleveland community. The Board Development Committee was formulated to identify potential Board members and to review and make recommendations for revising the bylaws of the Advisory Board.

Attendance at the five Advisory Board meetings increased during the school year. The number of people attending the meetings ranged from 20 to 31, with an average attendance of 24. Of the 39 people listed as members of the Board in September, 1988, all but seven--two teachers and five business representatives--attended at least one meeting. During the year, two teachers and three business representatives were added to the Board. Teachers, business representatives and higher education representatives were well represented at each meeting. Over the year, the number of business representatives increased steadily from four in September to 13 in May. Eleven members--the mathematics supervisor, five teachers, two from higher education, two from business, and the collaborative director--attended all five meetings.

Ms. Pence made a special effort to increase the attendance of business representatives at the Advisory Board meetings. In October, she requested that Dr. Richard Klein of the Nordson Corporation convene a meeting of Board members from business and industry in order to reaffirm and redefine their role as representatives to $C^2$ME. At the meeting, Mr. Bill Bauer made a presentation on the changing mathematics curriculum. The 12 Board members present decided they could support the collaborative both monetarily and philosophically, but felt that they needed more information on the NCTM Standards. At the November meeting of the Advisory Board, this group of business representatives recommended that the Board sponsor a symposium on the impact of mathematics curriculum reform on teachers, business and higher education. The Board decided to invite Henry Pollak to be guest speaker. Dr. Pollak is a visiting professor at Teachers College of Columbia University and a retired mathematics researcher from Bell Telephone Laboratories. In February, a few Board members met with Dr. Driscoll and Mr. Lord from EDC to discuss $C^2$ME's role as an advocate for the NCTM Curriculum and Evaluation Standards.

At the March meeting of the Board, the mathematics supervisor explained the NCTM Curriculum and Evaluation Standards to the 28 members in attendance and informed them that a number of teachers had been working on implementing these recommendations. As examples, teachers sitting on the Board discussed the NSF Problem-Solving Infusion Project, computer bulletin boards, calculators, and string art as used in geometry. Ms. Pence then requested that the Board consider an advocacy role for $C^2$ME in promoting the Standards and appointed the Advocacy Standing Committee, chaired by Dr. Klein. The Board sees this meeting as a transition point for the collaborative from Phase I (the enhancement of professionalism of mathematics teachers) to Phase II, the advocacy of reform in teaching mathematics.

At the May meeting, Dr. Klein reported that the ten people in attendance at a May 16 meeting of the Advocacy Standing Committee determined that a primary responsibility of $C^2$ME is to advocate discussion and experimentation of the new Standards within the community. Dr. Klein shared a draft of a statement with the Board that would be voted on at the next meeting. Dr. Klein stressed the need to address three groups: teachers, school administrators, and the public/media. He suggested that several corporations may be interested in funding grant requests to develop model schools in the district. Secondary school principals were encouraged to submit proposals outlining what could be done to increase participation in rejuvenated mathematics programs if additional funding were available. It is hoped that two schools will be selected to implement their model school programs when funds are identified.

In addition to developing a strategy for advocating the Standards, the Board meetings served as a forum in which current information on collaborative programs and other related activities was provided. Board members were invited to visit classrooms, and a sign-up sheet was distributed at the January meeting. At least one Board member took advantage of this offer. Dr. Pollak addressed the January meeting of the Board and emphasized that industry must assume an active role in mathematics education by contributing financial and human resources, as well as equipment. In addition, Dr. Pollak suggested industry must serve as a catalyst for improving mathematics education by making teachers aware of employment needs. At the May meeting, the Board Development Committee presented the revised bylaws, which were to be voted on at a future meeting. The Program Committee reported that at its April 21 meeting, the eight members in attendance recommended that the collaborative continue the dinner symposia, the Aetna mathematics clubs, professional conferences, seminars, and workshops. The Program Committee also recommended that institutes, seminars and workshops be continued, and that a stipend be available to motivate teachers to attend. The Public Relations Committee, in response to the lack of media coverage of the John Carroll Math Contest, noted the need to package the story and to provide the media with events that could be photographed. The committee also presented a grid that identified audiences important in implementing the Standards, reasons they may be skeptical, and benefits if the Standards are implemented.

## Teacher Advisory Board

The 17-member Teacher Advisory Board (TAB), with Mr. Richard Wittman as its spokesperson, is scheduled to meet every second month. During 1988-89, four meetings were held. At its September 29, 1988 meeting, discussion focused on future activities and strategies for involving business representatives in the collaborative. As a result of the meeting, the coordinator was asked to find teacher volunteers to host business representatives in their classrooms. The range of issues discussed at the other meetings included the collaborative's decision-making process, mathematics teachers' professional days, the Resource Center, and professional conferences and workshops. The TAB selected two teachers from Cleveland to attend the Leadership Conference to be sponsored by EDC in August, 1989. Discussion at the May meeting centered on suggestions for supporting the new Standards, the use of calculators in mathematics contests, and ways to enhance parental support.

The TAB sent a letter to Superintendent Tutela to request a meeting to discuss scheduling a system-wide professional day to allow teachers across the district to meet by content area and discuss the variety of activities they have attended. In Mr. Tutela's written response, he indicated that professional days are planned at the school level and suggested teachers use out-of-school time to meet with their district colleagues. He did offer further assistance if it were needed.

## Curriculum Committee

In September, 1988, the school district established a mathematics curriculum committee to discuss the new content with which teachers had become familiar at institutes and workshops, including the NCTM Standards. According to the on-site observer, many teachers have expressed enthusiasm about the curriculum committee and the topics it will address related to the new technology.

### Teacher Participation

Sixty percent of the district's intermediate and secondary mathematics teachers attended at least one $C^2$ME activity during the school year, a total slightly less than the 65 percent who participated the previous year. About a third of the teachers in 1988-89 attended three or more activities.

## D. Project Activities

In keeping with its goals to provide teachers with opportunities for professional growth, in-service training and enhancement of classroom instruction, $C^2$ME sponsored a variety of programs for high school mathematics teachers during the 1988-89 school year. In addition to activities offered by the collaborative, $C^2$ME encouraged teachers' participation in a variety of local and national institutes, seminars, workshops and conferences.

### Workshops and Symposia

#### Topics In Advanced Mathematics

On August 22-23, the collaborative sponsored a workshop to examine topics in fourth-year high school mathematics and to provide instruction in software developed by the North Carolina School of Science and Mathematics (NCSSM). Topics discussed included elementary data analysis, geometric probability, modeling, functions and matrices. Participants received a textbook written by NCSSM, as well as a set of the software.

The workshop, which was held at the Cleveland School of Science (CSS), was presented by two of the three mathematics faculty members from CSS who had participated in a program on fourth-year college preparatory mathematics at NCSSM during the summer of 1987. All ten participants were collaborative teachers.

## The Computerized Gradebook

On September 27, $C^2$ME sponsored a two-hour workshop at the Mathematics Teachers Resource Center to provide teachers with hands-on experience with the computerized gradebook. All Cleveland mathematics teachers were invited to attend, although participation had to be limited to the first 20 applicants. In addition to the presentation by Mr. Wallace Havenhill, CPS mathematics teacher, all the participants received free software and information regarding the Center's bulletin board. It has been reported that all the teachers who were at the workshop have actually used the gradebook in their classes.

## Every Minute Counts: Making Your Math Class Work

On November 17, 1988, the collaborative sponsored a workshop featuring Mr. David Johnson, chairman of the Mathematics Department at Nicolet High School in suburban Milwaukee and author of the books, Every Minute Counts, and Making Minutes Count Even More. Mr. Johnson provided tips on the art of questioning, efficient homework correction, and a practical notebook system, as well as suggestions for daily organizational techniques. Approximately 60 persons, including 49 teachers and eight Advisory Board members representing higher education and business and industry, attended the workshop, which was held at Baldwin-Wallace College. Each participant received a copy of Mr. Johnson's book.

The teachers were very enthusiastic about the workshop. One teacher commented, "I tried his technique and it really worked. His questioning techniques work for geometry." Another added, "He was great. I can see myself using the material and techniques in my class. It does work."

## Graphing Calculator

On February 21, 1989, the collaborative sponsored a workshop on the graphing calculator. Held at Cuyahoga Community College, the workshop was conducted by five collaborative teachers, including Mr. Ken Kubach. Mr. Kubach is one of the teachers selected to pilot the Calculator/Computer Precalculus Project, which was funded by NSF and developed by Ohio State University. Twenty-six mathematics teachers and three science teachers attended. Each attendee was given a graphing calculator.

## Henry Pollak Dinner Symposium

On January 9, 1989, BP America, with additional support from Case Western Reserve University, National City Bank, and Nordson Corporation, hosted an evening with Dr. Henry Pollak for $C^2$ME teachers. Dr. Pollak, a consultant and visiting professor at Teachers College of Columbia University, spent 35 years as a mathematics researcher for Bell Telephone Laboratories and Bell Communications Research. He has served on many mathematics advisory boards and is currently a member of the Mathematical Science Education Board.

The symposium opened with a 6 p.m. reception. Following dinner, Dr. Pollak spoke on "The New Mathematics Standards: Impact on Educators and Employers." In his presentation, Dr. Pollak emphasized the need to change the curriculum to better meet the needs of the students in preparing them for life after school.

More than 110 teachers and $C^2$ME Advisory Board members attended the symposium. Although a few of the participants commented that the speech was a little long, everyone was very enthusiastic about the curriculum changes that Dr. Pollak proposed. One teacher commented, "It was interesting to learn that calculators will be able to do about 95 percent of all algebra and 80 percent of all calculus problems in the future. If copies of the Standards would have been available after Dr. Pollak's presentation, I think many teachers would have taken a copy, read it, and used it. I enjoyed the reception and dinner." Another teacher said, "The message was good, but I would have preferred something like this in videotape format or a longer workshop on a Saturday. There was no time to digest what was said or to develop ideas." An Advisory Board member from higher education remarked, "The topic of the presentation was excellent and the examples given were excellent. The development of ideas was average. $C^2$ME has always presented excellent symposia and this was no different."

The decision to present a symposium on the impact of mathematics curriculum reform on teachers, business and higher education was an outcome of a business/industry brainstorming session held in October, 1989. Prior to the symposium, Dr. Pollak met with the $C^2$ME Advisory Board and spoke on the need for industry to take an active role in mathematics education. He stressed that representatives from industry should not only contribute financial assistance, human resources and equipment to our nation's schools, but even more important, should serve as a catalyst, constantly making educators aware of their employment needs.

### End-of-Year Dinner

On June 8, 1989, from 4:00-7:30 p.m., the collaborative hosted the third annual end-of-year dinner meeting to honor retiring teachers. More than 75 teachers and $C^2$ME staff attended the event, which was held at Hofbrau Haus Restaurant. Mr. Bill Bauer presented a slide show, recounted the teaching history of the retirees, and presented each of them with a small gift. In addition, information about the NCTM Standards was distributed.

### Mathematics Teachers Resource Center (MTRC)

The Cleveland Mathematics Teachers Resource Center of $C^2$ME was established at the Metro Campus of Cuyahoga Community College in October, 1985, as a clearinghouse for information and a meeting place for Cleveland public school teachers. The MTRC, which is open from 3:30 to 6:30 p.m. Monday through Thursday, provides a variety of services to mathematics teachers, including a centrally located meeting place, a calendar of events, a database on teachers, computer access, an electronic bulletin board system, and desktop publishing facilities. The MTRC serves as the hub of the district's curriculum development and in-service training and the site of several collaborative events, including this year's welcoming reception for new teachers. The MTRC is also a center for the collection, review, and distribution of materials. It provides consultation services and distributes a list of recommended materials to each department chair in order to encourage mathematics departments to obtain supplemental textbooks, supplies, and materials, including calculators to help teachers implement an activities-based approach to mathematics instruction. The Center also posts a new problem each week for students on the electronic bulletin board system that was developed by CPS teacher Roger Muenger.

During the 1988-89 school year, the MTRC was staffed by CPS mathematics teachers Bill Stiggers and Les Moes, and Marge Nichols, a student in office administration at Cuyahoga Community College. Mr. Stiggers, a CPS teacher for 18 years, has served as a

MTRC staff member for four years. Mr. Les Moes, a CPS teacher for 21 years, has worked at the MTRC for three years.

In March, 1989, the staff met to discuss ways in which the MTRC could be more effective in serving teachers. There had been a decrease in the number of teachers using the facility as a drop-in, as well as in the use of the center as a gathering place for workshops and curriculum development. Furthermore, it had sometimes been difficult in the past to find teachers willing to staff the center. The Program Committee also discussed ways to increase teacher usage of the MTRC. Suggestions for the 1989-90 school year included hiring teachers with mathematics and computer experience to work at the MTRC one or two days per week, encouraging departments and committees to hold their meetings at the center, and having the Center sponsor workshops for teachers.

### Welcoming Event

The collaborative sponsored a welcome reception for new mathematics teachers at the Mathematics Teachers Resource Center from 4-6 p.m. on November 15, 1988. The event was held to make new teachers aware of the collaborative and to familiarize them with the MTRC.

All mathematics teachers new to the school system were invited to attend. The on-site observer reported that the teachers who were present seemed to enjoy themselves and expressed interest in becoming active in the collaborative. One teacher commented, "It made me feel important to have the math department welcome me to the system." Another added, ". . . The idea that help is available from the collaborative is important. I'm glad I attended." A third teacher said, "I am sure that I will attend more collaborative events now, because I see other teachers attending and I don't want to be left behind."

## Mathematics Clubs and Competitions

### Aetna Math Club

Since 1986, the Aetna Foundation has contributed over $50,000 to C$^2$ME to help fund mathematics clubs in the Cleveland intermediate and high schools, including $18,000 for the 1988-89 school year. During the 1986-87 school year, prior to the grant, only ten math clubs had been established in the district secondary schools; during 1988-89, 31 of the district's 42 secondary schools operated clubs.

As in previous years, funds of up to $400 were granted to each of the collaborative's mathematics departments to finance the clubs. The money is used for math manipulatives, field trips, software and mathematics competitions. Grants to schools were contingent upon a commitment to participate in at least three major mathematics competitions during the school year.

During the 1988-89 school year, the mathematics clubs focused on activities that involved critical thinking and problem solving. The clubs also worked to inform students and parents about careers that emphasize mathematics. In addition to the Aetna funding, software, manipulatives, and mathematics literature were available to the clubs at the MTRC, and the computer bulletin board posted problems for students in grades 7-12.

## $C^2$ME/John Carroll Mathematics Competition

On Monday, May 15, 1989, $C^2$ME, in conjunction with John Carroll University, conducted the third annual Mathematics Competition for Algebra and Geometry, with an Advanced Mathematics competition added this year. The competition was created to encourage academic excellence, to give students positive academic experiences outside the classroom, to provide problem-solving experiences, to recognize outstanding mathematics students, to inform the public about the mathematics curriculum, to serve as a talent search for outstanding students, to encourage students to enroll in higher-level mathematics courses, and to provide students with nonathletic competitive experiences.

A total of 504 students, representing 25 CPS intermediate and high schools, participated in the competition, more than three times the number of participants in the 1987-88 contest. One participant was blind and two were partially sighted; braille tests were provided for these students. A fourth hearing-impaired student was assisted by a person who signed instructions and other information. The competition, which was held at John Carroll University, began at 10 a.m. Following the last event, lunch was served to all the participants. After lunch, the awards were presented. Each student who participated received a t-shirt, donated by Aetna Life and Casualty. The competition was intentionally held during school time to demonstrate that a mathematics competition was a viable reason to withdraw students from regularly scheduled classes. Traditionally, students had been excused only for athletic competitions.

The on-site observer reported that the event was very successful. "The activity created a competitive atmosphere in the schools, causing teachers to work more closely with students. The students benefited by working as a team and learning more mathematics. Each student is recognized at the awards ceremony so the students are made to feel good about mathematics. . . . A good competition with much work done by the mathematics department at John Carroll University. A prime example of collaboration among teachers, universities and business."

Evaluation of the event raised issues that included the contest's May date, during the week that students were preparing for AP examinations; a minor problem with student transportation by mini-van; extending the awards to acknowledge the third- and fourth-place teams; and allowing more time for the award presentations (the time was limited due to the transportation schedule). The Teacher Advisory Board expressed disappointment at the lack of major media coverage at the competition.

### Math Triathalon

On June 2, 1989, $C^2$ME, in conjunction with Cleveland State, conducted a mathematics competition for students in sixth grade. In total, 260 students representing approximately 50 schools participated in the day-long event. The competition was sponsored by Stouffer Foods Incorporated, which provided a t-shirt for each participant.

### Problem-Solving Infusion Project

In November, 1988, the Cleveland Education Fund received a four-year $400,000 grant from NSF to develop a program to infuse problem solving into the seventh and eighth grade mathematics curriculum. All seventh and eighth grade mathematics teachers were invited to a kick-off dinner for the project at the end of November, 1988. Of the 32 teachers in attendance, 11 volunteered to consult on the project during the year for a stipend of $50 per meeting. The principal consultants for the project are Dr. Rudd Crawford of Oberlin College and Dr. Richard Little of Baldwin-Wallace College. Dr. Crawford and the teachers met at the MTRC from 3:30 to 5:30 p.m. two Thursdays each month during the second semester. At these meetings, Dr. Crawford distributed worksheets of problems that require visual thinking and processing information from visual to verbal and back again. The teachers worked the problems and discussed them. They also shared their classes' reactions to problems that had been presented the previous week. The problem worksheets that are being developed will be collected in a notebook next year to be made available to other teachers through the Math Teacher Resource Center.

### Math Camp

Three collaborative teachers, Baldwin-Wallace mathematics professor Dick Little, and former Ohio Teacher-of-the-Year Diane Olix were instructors in Math Camp during the summer of 1988. Math Camp, a one-week summer program designed to enhance students' love of mathematics, was originally funded through a grant from the Ohio Board of Regents. Math Camp was an outgrowth of the Mathematics and Technology Human Resources Enrichment Project (MATHREP) project, which was initiated in 1987 to address the under-preparedness of mathematics teachers in the intermediate schools.

More than 60 middle school students participated in the summer program, which was held on the campus of Baldwin-Wallace College. Activities included soap-bubble geometry, kaleidoscope building, extensive geometry constructions using the compass and straight edge, mathematical patterns and sequences using the calculator, Euclid Puzzles, polyhedra building, and a mathematics scavenger hunt in the arboretum. C$^2$ME provided t-shirts for all participants.

### AIMS Program

C$^2$ME and the Cleveland Science Collaborative (CSC), jointly sponsored the AIMS (Activities that Integrate Mathematics and Science) Program. As part of this program, seven mathematics and nine science teachers regularly met at Baldwin-Wallace College, between January 12 and March 16, 1989.

## Regional and National Conferences and Institutes

Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The Cleveland Collaborative for Mathematics Education sponsored the attendance of ten CPS mathematics teachers at the NCTM conference in Orlando, Florida, April 12-15, 1989. Each participant received $600 for expenses. Teachers were selected based on the number of collaborative activities in which they had participated; one teacher commented that the participation requirement would encourage him to become more active in the future. Other requirements included NCTM membership and a willingness to write an article for the $C^2$ME newsletter. Two teachers who received funding made presentations at the conference. During the day the teachers attended a wide variety of sessions, all of which centered on the conference theme, "Vision for the World of School Mathematics." In the evening, the teachers participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Teaching and Curriculum Program.

The teachers reported that the conference was very worthwhile. They noted that many of the presentations were geared toward the new Standards, and seemed motivated to make the changes necessary to implement them and eager to share what they had learned. One teacher, in the article he prepared for the $C^2$ME Newsletter, wrote, "Attending educational conferences provides teachers with many opportunities for growth and renewal. The ability to share with other teachers from other school systems, states or even countries and place our own problems into perspective, to me, is the greatest reason for our attending them. This year's conference in Orlando, Florida brought to our attention the new Standards, the Japanese challenge, and a host of ideas to suit anyone's tastes." Another teacher wrote, "The underlying message of the sessions that I attended at the NCTM convention was that students who actively operate [on] what they already know of their environment, through action, manipulatives and imagery, are the ones who are really expanding their knowledge and comprehension of mathematics. To prepare for the 21st century we need to enable our students to become more mental, electronic, and verbal in their work. Gone are the days when a student simply carries out instructions in a teacher-directed situation--'watch me, watch me, now do it . . . . .' I would like to share with you, fellow colleagues, and urge you along with me to re-think and re-examine our teaching methods. Let us try something new; let us not teach the way we were taught. Let us keep our professional growth on the same exponential curve that the field of mathematics is on." A third teacher wrote, "I attended three presentations on spreadsheets at NCTM . . . . I feel that spreadsheets will become an important tool in mathematics education. I have been experimenting with spreadsheets for almost a year and have used them in my own classroom for the last six months. Basic spreadsheet operations can be taught in a few minutes and all Cleveland high schools own the Multiplan spreadsheet. I would be happy to present a workshop on spreadsheet applications. Please contact the $C^2$ME office if you have an interest in this topic."

## Ohio Council of Teachers of Mathematics Conference

$C^2$ME funded 31 teachers to attend the Ohio Council of Teachers of Mathematics (OCTM) Conference in Toledo, Ohio on April 28 and 29. Four CPS teachers, as well as three other collaborative members, gave presentations at the conference.

The teachers appreciated the opportunity to participate in the conference. One of the teachers commented that Cleveland teachers are more advanced than their colleagues from other cities in their activities and in use of equipment.

## Small Grants Program

$C^2$ME provided consultation and assistance to mathematics teachers who applied for grants from the Small Grants Program of the Cleveland Education Fund. This program was established to support innovative projects that enrich and strengthen the learning experiences of Cleveland public school students. By providing seed money for instructional experimentation, the fund makes it possible for educators, parents and students to put imaginative ideas into practice. Applications are reviewed for both educational content and originality; projects that are given priority have potential implications beyond the grant period, are interdisciplinary and include a parental involvement component.

During 1988-89, the fifth year of the small grants program, the Cleveland Education Fund received 353 proposals and awarded 142 grants totaling $60,319.15 to encourage creativity in the classroom. As in previous years, only projects with educational content were considered. The three deadlines for submitting requests were October 10, 1988;

January 10, 1989; and April 10, 1989. Awards for mathematics-related projects maintained previous levels, with 22 in 1987-88 and 23 in 1988-89.

## Teacher Scholarships

As part of its commitment to $C^2$ME, the Department of Mathematics at John Carroll University continued to offer tuition scholarships to mathematics teachers in the Cleveland Public Schools. Scholarships cover tuition for university mathematics courses, ranging from introductory calculus and statistics to graduate courses in the department's Master of Arts and Master of Science programs. No awards were made for summer 1988-89.

## $C^2$ME Newsletter

The collaborative's quarterly newsletter was distributed to teachers and Advisory Board members throughout the 1988-89 school year. The newsletter announces events, programs and contests; recognizes teachers for personal accomplishments and $C^2$ME participation; and prints articles of interest to mathematics teachers. The spring newsletter, for example, included a special bulletin on the NCTM Curriculum and Evaluation Standards written jointly by the Mathematics Department Chair at Case Western Reserve University, Professor Wojbor Woyczynski, $C^2$ME chairperson Ms. Barbara Pence, and CPS teacher Mr. Robert Seitz.

In fall, 1987, the original editor of the collaborative newsletter resigned due to time constraints after having edited the newsletter for two years. Mathematics teacher Mr. Ken Fiore edited the newsletter for the 1987-88 school year. In fall, 1988, Ms. Charniece Buford (Holmes) became responsible for its publication. The Program Committee, at its April 21, 1989, meeting discussed the newsletter and determined that a committee of four volunteer teachers will review and edit the articles and see that photographs of events are included.

## E. Observations

### Project Management

After a year of transition in 1987-88, the management of the Cleveland Collaborative for Mathematics Education has stabilized. Collaborative Director Barbara H. Patterson has provided the leadership necessary for the collaborative to continue enhancing the quality of mathematics education in the Cleveland Public Schools. She has accomplished this at a time when the Cleveland Education Fund was expanding its programs in other areas. Because of her involvement in this expansion, Ms. Patterson depends on the collaborative coordinator to assume greater responsibility for the daily operations of the collaborative.

Both the Advisory Board and the Teacher Advisory Board were very active in addressing collaborative issues during 1988-89. The Advisory Board worked to increase the participation of business and industry, and to develop an environment of advocacy for mathematics education reform in Cleveland. This action was initiated by the new Advisory Board Chair, who observed that the business members on the Board appeared disengaged; in response, she formed a subcommittee of business representatives to address this issue. The group met in October and decided the Board should focus on the NCTM Curriculum and Evaluation Standards; in order to do this, it was necessary to become more familiar with the Standards and to understand their underlying concepts. This realization prompted the Board to invite Dr. Henry Pollak to give a presentation.

The Teacher Advisory Board has evolved into an important decision-making body for the collaborative. The TAB engaged in strategic planning to increase business involvement, including its efforts to invite local business people to visit mathematics classes; addressed CPS district policies by contacting Superintendent Tutela regarding in-service days; and developed a selection process by which NCTM attendees and participants at the Leadership Conference in August, 1989, would be chosen.

C$^2$ME's management structure has evolved from its developmental stage in which initiatives were largely director-driven to one in which management responsibilities are shared among the Boards and their supporting committees. The Advisory Board defines the collaborative's overriding vision and goals and sets policy. The Teacher Advisory Board and its Program Committee are responsible for program planning. This reorganization has occurred as a result of several factors, including the willingness of teachers to assume more decision making and leadership; an increasingly stronger commitment by business, industry, and higher education representatives to the collaborative and its success; and a change in directors resulting in a different management style. Issues that have arisen as a result of this changing management structure are now being confronted. Among the new complexities are the need for committees and the Boards to communicate more effectively and to cooperate in decision making; and even such basic problems as determining a meeting time that can accommodate both teachers and business people.

$C^2$ME has been successful in assigning to teachers certain collaborative responsibilities that are typically assumed by office staff in other collaborative sites. Examples include staffing the Math Teacher Resource Center and editing or advising for the $C^2$ME newsletter. While the teachers who run the MTRC receive a stipend for their efforts, they work regular hours at the Center after their normal teaching duties. This kind of teacher participation provides the collaborative with a teacher-active identity.

### Collaboration

Collaboration among Advisory Board members is noteworthy. Representatives from business, industry, and higher education come together with teachers and the mathematics supervisor to conduct the business of the collaborative. The consistent attendance of Board members from all sectors, as well as their willingness to participate in special projects and activities, indicates a strong commitment to the collaborative. Board members from higher education offer summer institutes for teachers and operate the mathematics contest. Business and industry representatives have opened their work sites for special collaborative events such as site visits, symposia, and dinner meetings. Unlike similar boards in some of the other collaboratives, the Advisory Board, as well as $C^2$ME's administrators, have taken the initiative to keep business and industry representatives involved in the collaborative and to increase the number of local business people who are active in its development.

The Advisory Board has provided a structure for gaining community and teacher support for the reform of the mathematics curriculum. When the NCTM Curriculum and Evaluation Standards were released, the Board provided a viable structure through which to advocate the Standards. This advocacy role did not occur automatically, but rather resulted from a chain of events that involved the Advisory Board, teachers and the mathematics supervisor taking the time to discuss the changes needed in mathematics education; inviting a credible speaker such as Dr. Henry Pollak to talk to the group; and assigning a committee to address the issue. As a result of these efforts, a mathematics professor wrote an article for the collaborative newsletter proclaiming support of the Standards. Members of all three sectors work together on the Advocacy Committee to brainstorm about ways $C^2$ME can mobilize community support for the Standards.

The Advisory Board provides teachers with access to experts who are knowledgeable about the workings of the local community. For example, in regard to publicity for the mathematics contest, a Board member from business advised teachers to package an appealing news release rather than to write a letter to the newspaper pointing out its lack of coverage. These and other similar occurrences support the statement of one teacher, who, when asked the most significant changes that can be attributed to the collaborative, responded, "We now have community involvement in mathematics education, where before we didn't have any."

In addition to providing a structure for generating community support, the collaborative has removed barriers and helped increase professional interaction among teachers, and between teachers and other mathematics users. Sixteen teachers were asked how the collaborative has helped them form relationships with other mathematics teachers and with other mathematicians in business and in higher education. Fifteen of the 16 teachers reported improved interaction, especially with teachers from other schools. Over a third of the teachers reported having had opportunities to share ideas or to interact with representatives from business, industry, and higher education. Only one of the sixteen teachers, a teacher who only occasionally participates in collaborative activities, noted that interactions with those other than teachers, was casual: "[The collaborative] has helped a lot with teachers. I get to discuss problems with them. The association with other mathematicians is only superficial." In contrast, a teacher who frequently participates in collaborative activities responded to the same question: "[The collaborative] has brought our mathematics department closer. We can now share with teachers at other schools. The symposia bring together the teachers, mathematicians in business and higher education. We now know how math is used in 'real life.'"

**Professionalism**

Mathematics teachers have assumed a more active role in collaborative decision making over the past year. This has occurred in large part as the result of teacher leadership that has emerged on the Teacher Advisory Board. The NCTM Curriculum and Evaluation Standards also served as a focus for teachers' interest and support. Through discussion on the Advisory Board and the presentation by Dr. Henry Pollak, the business collaborative members have been convinced of the importance of the Standards. Their interest, in turn, has motivated teachers to take action, and discussion groups have formed to explore ways to implement the Standards. A mathematics teacher wrote a letter to Superintendent Tutela explaining why the Standards need to be implemented; other teachers are giving presentations on the Standards. The impact of these efforts is evident in the classroom, where many teachers have expanded their use of manipulatives and increased their emphasis on problem solving.

Active collaborative participants attributed their increased involvement in school-related decision making to their involvement in $C^2$ME. Sixteen teachers were asked about the effect the collaborative has had in this regard; ten of the 12 respondents, all of whom are frequent participants in collaborative activities, answered by positively affirming that the collaborative has drawn teachers into the decision-making process. One teacher responded, "Collaborative members are an increasingly larger part of the 'piece of the action' activities such as text selection, Pupil Performance Objectives, evaluation and other activities formerly dominated by administration." A department head answered the same question, "$C^2$ME has motivated me to be more outspoken in my building in favor of changes in the curriculum and in changes in teaching strategies." In contrast to the responses of frequent collaborative participants, three of four teachers who were only occasional collaborative participants indicated that they had not experienced any change. One of these teachers responded, "Not too much, because I have usually been selected for these committees in the past." Another occasional participant and a department head observed, "Not at all. The involvement comes from the math supervisor, not the collaborative." It is clear, then, that those teachers who are actively involved in the collaborative are experiencing changes, and that these shifts in professionalism are less apparent to the occasional participants. Because the mathematics supervisor has been able to integrate the work of the collaborative into what he does, it is understandable that some teachers are unclear whether the changes are coming from the supervisor or from the collaborative. As one frequent participant noted, "I'm not sure if the effect on the curriculum is more from the math supervisor or $C^2$ME."

The Math Teachers Resource Center has contributed to a greater sense of professionalism among mathematics teachers. The Center, operated by teachers, for teachers, is a meeting place that they can call their own. Collaborative committees often meet at the MTRC, as do mathematics teachers and the mathematics supervisor. It was regularly used as a meeting place for teachers on the Problem Solving Infusion Project. The MTRC is a place whose existence is directly linked to the collaborative. It contributes to a strong professional identity for mathematics teachers in Cleveland.

In many ways, 1988-89 was a transition year for the C$^2$ME as it moved from Phase I of building a collaborative to Phase II of putting the collaborative to work to affect mathematics education in Cleveland. Phase I was successful in bringing teachers together and motivating them to get involved. One teacher reported that the most significant change attributed to the collaborative was, "a desire of many teachers to become involved as knowledgeable participants in curricular decisions." Another teacher, responding to the same question, said, "Allowing teachers to feel and act like professionals. It has been a support system to use ideas that teachers have, instead of just wishful thinking." The attention that has been given to mathematics teachers and the resources that are provided for them to attend conferences and other activities have caused tension between some mathematics teachers and teachers in other content areas. One mathematics teacher commented that teachers in other divisions were envious of mathematics teachers getting to go to places such as Orlando and that she heard that another teacher complained to the principal about her work schedule.

The collaborative has been successful in enhancing the professional lives of mathematics teachers in Cleveland by bringing more of them into the decision-making process, by providing them with opportunities to learn more about mathematics and how it is used, and by building a support system within the community and surrounding area. As a result, teachers are more involved and, as one teacher said, have "an improved sense of professionalism and a feeling that we, as math teachers, are actively improving the math curriculum to more appropriately meet the technological demands of our society."

## Mathematics Focus

C$^2$ME's mathematics focus during the year was clearly centered on the NCTM Curriculum and Evaluation Standards. A concerted effort was made by the collaborative to build community support for the Standards; work towards this end began even before the Standards were officially released in March, 1989. The effort included the formation of an Advocacy Committee of Advisory Board members, a presentation by Dr. Pollak that provided a rationale for the Standards, discussions by teachers and the mathematics supervisors aired on local radio programs, publication of an article by a local mathematics professor in the C$^2$ME newsletter in support of the Standards, and a new curriculum committee established by the mathematics supervisor to discuss topics and to decide how to implement the Standards. In addition, the collaborative has provided a climate for advocacy of other mathematics-related programs, such as the Model School Program.

The momentum that has been generated during the year did not just occur; it must be attributed, at least in part, to an environment of change that has been evolving since the initiation of the collaborative. This environment has included a number of projects, summer institutes, presentations, site visits, committee work, and the active involvement of teachers, mathematics supervisors, and community representatives. As a result of this preparation, teachers have had access to some of the best knowledge available with regards to mathematics education and the use of technology in the teaching of mathematics. When 16 teachers, 12 of whom were frequent participants and four occasional participants, were asked if their awareness of the current national trends in mathematics education had increased as a result of the collaborative, all 16 answered in the affirmative. These teachers explained that their awareness had increased through workshops, meetings, conferences, the C$^2$ME newsletter, materials sent by the collaborative, discussions, and contacts with those in higher education. Noted most frequently by the teachers was an increased knowledge of calculators and other forms of technology. One teacher responded, "I've been more aware of mathematics instruction as a tool to keep up with modern technology . . . . The calculator/computers are to be infused within our daily lesson plans. New courses such as discrete mathematics are a wave of the future." These teachers were aware of and in agreement with the current trend toward problem solving and critical thinking. Some teachers also supported teaching probability and statistics.

Teachers have been encouraged by some of the changes taking place in their district. Changes are being made in the mathematics curriculum. One teacher reported an increase in mathematics test scores. More than 500 students, as compared with 144 the previous year, participated in mathematics contests and more than 30 schools have mathematics clubs. The superintendent allocated an extra mathematics teacher to each comprehensive high school solely to help at-risk students. Despite these gains, however, problems remain; during 1988-89, there was a 50 percent failure rate in the district's Algebra I classes.

While mathematics teachers have been greatly affected by the mathematics collaborative, a decline has been noted in the percent of teachers participating in collaborative activities. This raises the question of whether participation is leveling off to those who are really committed to the concept of collaboration, or if there is a need, as teachers become more sophisticated collaborators and the collaborative itself becomes more diffused in the district, to change the way teachers are engaged in the collaborative. It should also be noted that a percentage count of teachers attending collaborative activities may not be fully representative of teachers' participation. The issue of participation and commitment is directly linked to the staying power of the collaborative and the answer will affect what happens in Phase II. What is apparent today is that Phase I was successful; as one frequent participant reported:

> Because of the collaborative my whole attitude toward teaching math has changed. Through things like the problem-solving workshop, calculator workshop, dinner meetings, math clubs, math resource center, etc., I have become rejuvenated and motivated in a whole new light. This has taken place at a time when I was seriously considering getting out of teaching after 18 years. I can honestly say the collaborative has changed my mind.

## F. Next Steps

In Phase II, the $C^2$ME will continue to focus on the NCTM Curriculum and Evaluation Standards. The Problem-Solving Infusion Project, which will enter its second year, will complete the development of problem units and will begin to distribute the material to other teachers. During the summer, several opportunities for professional development will be available to mathematics teachers. These include the Ohio State University Calculator and Computer Pre-Calculus Project, the Cleveland Teacher Internship Program, summer mathematics courses at John Carroll, the Mathcamp for teachers and students at Baldwin-Wallace College, and an August 24, 1989, $C^2$ME fall workshop at which a variety of sessions will be presented by Cleveland teachers. An IBM Dinner Symposium is planned for November, 1989. During the 1989-90 school year, the Cleveland Education Fund will initiate the Model Mathematics Project ($M^2$P), granting awards ranging between $50,000 to $75,000 to two high schools to develop model high school mathematics programs that reflect the NCTM Curriculum and Evaluation Standards.

# SUMMARY REPORT:
# DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Durham Mathematics Council for the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Durham Mathematics Council to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

# DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

## A. Purpose

Since September, 1988, the Durham Mathematics Council has pursued a three-year plan to reform mathematics education through teacher empowerment. In keeping with this plan, DMC activities until 1991 will strive to foster professional independence and to establish the means by which the organization will become self-supporting. In particular, activities will be designed to encourage and stimulate teachers to effect change in both mathematics curricula and methodology, thereby empowering them to assume control of their professional practices and growth.

The Phase III proposal, submitted to the Ford Foundation in May, 1988, specified objectives for three types of activities: out-of-school, in-school, and networking. Guidelines required that activities were teacher-generated, flexible and innovative, and inclusive of all mathematics teachers.

The objectives of the out-of-school activities are:

1. To motivate teachers to become involved in professional activities;
2. To provide opportunities for teachers to learn what is occurring nationally in mathematics;
3. To provide teachers opportunities to examine mathematics programs in other areas;
4. To provide growth opportunities for teachers as mathematicians; and
5. To empower teachers with the responsibility and strategies for effecting change.

The objectives of the in-school activities are:

1. To assist teachers in the implementation of new methods and topics into their teaching of mathematics;
2. To help foster collegiality among members of mathematics departments in the schools; and
3. To provide teachers with materials necessary for the effective teaching of mathematics.

The objectives of the network activities are:

1. To counteract the isolation normally experienced by mathematics teachers;
2. To provide an opportunity for mathematics teachers to become informed about how other mathematicians apply their knowledge;
3. To educate non-teachers on needed changes in mathematics;
4. To develop collegiality among area mathematicians and mathematics teachers; and
5. To provide special opportunities normally found in other professions to teachers.

In achieving the reform of mathematics education through teacher empowerment, it is expected that the three types of activities will occur simultaneously rather than sequentially. Out-of-school activities will serve as the catalyst of mathematics reform. In-school activities spur that reform and transform it from ideology to action. Networking activities, which foster collegiality among teachers and area mathematicians, provide professional support as well as resources to mathematics teachers working toward mathematics reform.

## B. Context

The city of Durham, situated in a metropolitan area of 160,000, has a population of approximately 105,000. The city and county maintain separate governments and responsibilities, and the two school systems act independently of each other. Local philanthropies have helped to establish the Durham Public Education Fund (DPEF), founded in 1986, to serve both the city and county schools and to foster a commitment to public education in the private sector. The A.J. Fletcher Foundation awarded a grant of $77,000 to the DPEF to pay the salary of an executive director.

The Durham community is served by the Durham City and Durham County Schools. Because the geographical districting of the two systems does not conform to city and county boundaries, the areas surrounding several county schools are located within the City of Durham. These areas were not in the city when the schools were built but have since been annexed by the city.

## The Durham County Schools

The Durham County Schools consists of 22 schools, including five middle schools (grades 7-9) and three senior high schools (grades 10-12). Approximately 17,500 students attend county schools, of which 71 percent are white and 29 percent are black. Less than 1 percent of students in the district have English as a second language. Approximately 14 percent participate in federally funded lunch programs. The truancy rate of students in the county schools is 6.13 percent.

Enrollment in the district is increasing, resulting in overcrowding in county schools. The impact of private schools in the district is relatively minor. A plan for redistricting 8,000 students, developed at the Research Triangle Institute, resulted in the closure of an historic schoolhouse and the opening of two new elementary schools.

Approximately 4,000 students attend county middle schools. Sixty-nine percent are white and 31 percent are black. County sixth and eighth graders scored above the national average on the California Achievement Inventory (CAT) in 1988. Eighth graders scored two grade levels above the national norm in all three areas of the test: reading, language and mathematics.

Four thousand students in the district attend county senior high schools. Seventy-one percent are white and 29 percent are black. Less than 1 percent have English as a second language and 4 percent are in government-funded lunch programs. Currently, approximately 76 percent of Durham County Schools graduates go on to post-secondary education. The annual dropout rate is approximately 5.6 percent. Cumulatively, 28 percent of county students are expected to drop out before they graduate. Graduation requirements for county students currently include two units of mathematics, but that will be increased to three units for students in the 1992 graduating class. Any student who meets all course requirements for graduation but fails to pass one of the four sections of the required competency test may receive a certificate in lieu of a diploma.

Approximately 80 percent of high school students in the county system were enrolled in mathematics courses during the 1986-87 school year. On average, students take more than three mathematics courses during their high school careers.

The Durham County Schools employs 320 high school teachers. Sixty-four percent are women and 36 percent are men. Eighty-two percent of high school teachers are white and

18 percent are black. In 1988-89, annual salaries for Durham County teachers ranged from the state base of $18,330 to $30,430, plus the local supplement from the County Schools of $420 to $2,500. There is no teachers' union in the district, and teacher contract negotiations do not occur in the state of North Carolina.

In 1988-89, Durham County high schools employed 40 mathematics teachers. Seventy-three percent were female and 27 percent were male; 78 percent were white and 22 percent were black. Thirteen of the teachers held a master's degree and 27 held a bachelor's degree. All of the high school mathematics teachers in Durham County are certified to teach mathematics, and 63 percent are tenured. Another forty-six teachers taught mathematics in middle schools.

The school budget for the 1989-90 school year totalled approximately $105 million, a 5.4 percent increase over the 1988-89 school year. The increase was due, in part, to a 10 percent increase in local salary supplements to teachers and the elimination of pay inequities for teaching assistants. Forty-seven percent of the school budget comes from local resources, with the remaining 53 percent coming from the state. Per-pupil expenditures for the county system totalled $2,722 for the 1988-89 school year.

The district's projected budget for the 1989-90 school year totalled approximately $117 million, an increase of about 5 percent over 1988-89. Thirty-five percent of 1989-90 expenditures came from local funds.

County Superintendent Dr. Larry Coble resigned in the spring of 1989. The new County Schools Superintendent, Dr. Jerry D. Weast, placed school funding and the school merger dispute as the top priorities of his administration. Dr. Weast is noted for his financial savvy and for his success in creating uniformity in curriculum from school to school.

### The Durham City Schools

Enrollment in the Durham City Schools for the 1988-89 school year totalled 8,415 students. Of these, 64 percent were eligible for the government-funded lunch program. City schools do not experience the same overcrowding as the county counterparts, perhaps due to the movement of white students from the city to the county system. Eighty-five percent of students are black and 15 percent are white. In large part, students come from predominantly poor, single-parent families.

Durham City Schools reported the highest truancy and dropout rates in North Carolina for 1988-89. The truancy rate for city students is over 10 percent, and the annual dropout rate is 13.2 percent. Cumulatively, 46 percent of city students are expected to drop out before they graduate. Students in sixth grade scored, on the average, at the 32nd percentile on the CAT. Eighth grade students earned CAT scores, on the average, at the 35th percentile.

In 1988-89, Durham City Schools employed 20 secondary mathematics teachers and 21 middle school mathematics teachers. In 1987-88, 71 percent of the city's mathematics teachers were female and 59 percent were minorities. In 1988-89, annual salaries ranged from the state base of $18,330 to $30,430, plus the local supplement from the Durham City Schools of $400 to $2,000.

At the end of the 1987-88 school year, Dr. Cleveland Hammonds, superintendent of Durham City Schools, accepted a position as superintendent of schools in Birmingham, Alabama. A new superintendent, Dr. Hawthorne Faison, formerly of the Milwaukee Public Schools, was hired in April, 1989. Dr. Faison has said that he plans to be active in visiting schools and talking with teachers, students and administrators. He stressed to principals that respect for teachers as individuals and professionals and the authority that teachers have in their classrooms should be educators' primary concern. He has asked the school board to evaluate his performance regularly. At a Chamber of Commerce meeting, he proposed that all Durham high school graduates should be awarded a scholarship to continue their education.

The Durham City School Board estimates that it will need approximately $62 million for capitol improvements over the next five years. Revenues will build a new central high school and a new elementary school at a cost of approximately $33 million, with the remainder of funds going to renovating existing structures. Durham voters approved $18 million in construction bonds for city schools more than two years ago, but only one-third of the money has been used to build new schools and renovate existing structures. State regulations require that the money be used within three years or it will be subject to state income tax.

Budget requests for city schools for the 1989-90 school year total $15.9 million, an increase of approximately 8 percent over 1988-89. The budget is based in part on a 7 percent salary increase for teachers. This increase in per-pupil expenditures for the city system totaled $113 during 1988-89.

**Additional Information**

North Carolina's Basic Education Program has nearly doubled public school spending in the last five years in order to expand programs, add teachers, reduce class sizes and increase teacher salaries. At present, the program is expected to put $700 million each year into state schools. Sixteen school systems in the state are piloting a merit pay system, part of the Basic Education Program. Although teachers, administrators and government officials have expressed reservations about the policy, Governor Jim Martin hopes to expand the merit pay policy to include all of the state's teachers. The North Carolina Association of Educators (NCAE), the largest teachers' organization in the state and an opponent of the merit-pay program, released a survey showing widespread discontent among teachers in the 16 pilot systems. At the same time, the superintendents in the affected schools unanimously agreed that the program had a positive effect on student achievement. Despite this, the NCAE voted overwhelmingly to oppose extension of the system.

Salary disputes between teachers and the state resulted in the state Department of Public Instruction approving a pay increase for 1989-90 that will bring minimum annual salaries up to $20,500 and increase top salaries to $39,000. The pay plan was overwhelmingly supported by the NCAE, the Public School Forum of North Carolina and the North Carolina School Boards Association. As of March, 1989, North Carolina ranked 36th in the nation in teachers' salaries, with an average base salary of $24,900.

A plan to merge the two districts into a unified school district is being debated. Discussion has alluded to inequities existing between the city and county school systems, including per-pupil expenditure, racial balance and overcrowding. Teachers are split on this issue. A task force investigating the question has recommended a referendum on the merger. Voters have rejected merger proposals four times in the past, and it is commonly believed that the issue would be defeated unless it can be shown that both systems would benefit. In general, however, county voters believe they have an excellent system and they do not want to change it by merging with another system. A petition signed by more than 300 county voters opposed to the merger was presented to the Durham County School Board. Consequently, the board voted to oppose the merger.

## C. Development of the Collaborative

During Phase III, the Durham Mathematics Council will continue to operate out of the North Carolina School of Science and Mathematics, a state-funded residential high school for academically talented eleventh- and twelfth-grade students. The Dean of Special Programs and Research for NCSSM, Dr. Keith Brown, oversees the general activities of the collaborative and attends to fiscal matters and long-range planning. The executive director of the collaborative for 1988-89 was Dr. Helen Compton, a mathematics teacher at NCSSM since 1981. On June 1, 1989, she resigned as the executive director and announcements of the opening were distributed in July, 1989. Dr. Compton, who had worked 12 years in Durham City Schools before joining the NCSSM faculty, was responsible for the day-to-day DMC operations, working with teachers in planning and implementing activities, and serving as the liaison between the DMC Board of Directors and the teachers. She worked half time for DMC and taught half time. The executive director is assisted by a full-time secretary, Ms. Barbara Davis, who maintains DMC records, contacts teachers, and oversees the use of the resource center. Ms. Betty Peck, a retired mathematics teacher from the county school district, is the on-site observer. A total of 127 middle school and high school mathematics teachers in the Durham city and county schools are served by DMC and are encouraged to participate in its activities.

The structure of the collaborative has been developed such that both the executive director and secretary are employees of NCSSM who report to the Dean for Special Programs and Research. All DMC personnel matters are the responsibility of NCSSM, which provides space for offices and the resource center, and support services for the executive director and secretary. As a result of the relationship between the DMC and the NCSSM, the potential exists that DMC may be influenced by factors that affect the school. The collaborative administrative structure is embedded within NCSSM and thus can be affected by changes within the NCSSM organization or administration. In addition, the state's role as a major financial supporter of NCSSM may have implications for the collaborative. One natural implication is that DMC may serve as a model to be reproduced in some form in other parts of the state.

The governing structure of the DMC is considered distinct and separate from its administrative structure, and each has specific responsibilities. The dual structures were established in order to create an efficient and effective operating collaborative, with the executive director serving as the main bridge between the two structures. The governing structure is composed of two main bodies: the Board of Directors and the Steering Committee. The Board of Directors is responsible for setting policy, raising funds, and allocating funds, while the Steering Committee, consisting of one teacher from each school, is responsible for developing activities and is to assume an increasing role in implementing activities.

The Board of Directors is comprised of 16 members: nine representatives from area businesses and industries, two from local institutions of higher education, one representative and one teacher from each school system, and a representative from NCSSM. At the beginning of the 1988-89 school year, three new persons joined the board, replacing former members. The representative of the Durham County Schools, Mathematics Supervisor Herman Gatling, died in December and was replaced in July, 1989, by Judy Smith, curriculum coordinator for Durham County Schools. Dr. Keith Brown and Dr. Helen Compton, director and executive director, respectively, of the Durham Mathematics Council, attended the board meetings. The chair of the Board of Directors is Dr. Imogene McCanless, Director of the Biostatistics Department of Glaxo, Inc. Collaborative Secretary Barbara Davis recorded and prepared the minutes of the meetings.

The Board of Directors held six regularly scheduled meetings in 1988-89, on the afternoon of the third Wednesday of every other month beginning in July, 1988. In addition, the board convened three special meetings on December 7, April 26, and June 8. The first two special meetings were held to discuss fund raising, while the June meeting was set to conclude business that had not been completed at the board's May meeting. Because some board members had to leave the meeting early, there was a lack of a quorum and no decisions were made.

Members of the Board of Directors are assigned to serve on five committees: the Advisory Committee, the Finance Committee, the Public Relations Committee, the By-laws Committee, and the Nominating Committee. Ray Best of Duke Power, a new board member, will chair the Board of Directors in 1989-90. At the November meeting, committee assignments were announced and the By-laws Committee was asked to meet to clarify the duties and responsibilities of the committee chairs.

Fund raising was the board's major concern during 1988-89. The collaborative's goal was to raise $65,000 by June, 1989, to help pay for collaborative administrative expenses and for teachers' professional activities. Each school district contributes funds to the DMC and commits 70 to 75 substitute days for use by the DMC. Thurman Dortch, the chair of the Finance Committee, assumed primary responsibility for the fund-raising campaign. Bob Poole, North Carolina Central University Vice Chancellor for Development and a knowledgeable fund raiser in the area, addressed the Board of Directors at its special meeting in December. He outlined features of a successful fund-raising campaign: organization, identification of the best prospects, and cultivation of relationships with potential donors. Strategies that the board identified to solicit funds included sending letters to previous donors; board members individually contacting potential donors; hosting a breakfast for representatives of area businesses and industries; and forming a Friends of the Durham Mathematics Council group to support its efforts.

At its January meeting, the board reviewed a list of those who had contributed to DMC since its inception in 1985 and a list of Durham organizations with more than 100 employees. At the meeting, board members agreed to contact those contributors with whom they were personally acquainted, planned a breakfast in April for business and industry representatives, and agreed to meet in a month to continue planning fund raising.

On April 6, IBM sponsored a fund-raising breakfast for the collaborative. Twenty-three people, including 12 business representatives, attended. Barbara Scott Nelson of the Ford Foundation addressed the group and explained that the Ford Foundation grant now covers only the collaborative overhead and that all program and grant monies must come from fund raising. Vivian Leeper-Ford and Durham County schools Superintendent Coble also made brief presentations. Nearly $10,000 was raised at the breakfast. With these funds, along with pledges from the school districts, NCSSM, and other businesses, the collaborative raised its target funds for the year.

To foster a stronger relationship between the DMC and the NCSSM, and between the collaborative and teachers from other parts of the state, the NCSSM Math and Science Education Center received a Title II grant from the state to fund a Woodrow Wilson One-week Summer Institute on Geometry, to be held in July, 1989. The grant was to fund fees and stipends for 15 DMC teachers and 15 teachers from across the state. However, by the registration closing date in March, only nine DMC teachers had submitted applications. The other six slots were allocated to teachers selected from the nearly 90 applications received from outside of the Durham area. Dorothy Doyle, Director of the Math and

Science Education Center, who is also a member of the DMC Board of Directors, was instrumental in obtaining this grant.

The Advisory Committee is a prominent committee of the Board of Directors. This committee, chaired in 1988-89 by Mike Bunch of Measurement Incorporated, meets at least quarterly to distribute mini-grants and travel grants. During the year, the committee drafted a set of guidelines for allocating funds. In addition to examining the substance of a proposal, the committee considers the project's potential benefits to DMC in light of the collaborative's goals, the extent to which the applicant has participated in DMC activities, equity among different groups of teachers, and evidence of principal support where appropriate.

The board budgeted $21,000 in 1988-89 for teacher travel, grants, and mini-grants. By the May meeting, the monies allocated for travel had been dispersed to teachers applying to attend the NCTM Annual Meeting, a computer conference at Lesley College in Boston, the Exeter conference, and workshops in Durham. The Advisory Committee allocated nearly all of the available grant money at its May meeting. Recipients included two teachers who were to spend the summer writing geometry materials for the Resource Center, a teacher who was going to work during the summer writing materials for presentation in a workshop in the 1989-90 school year, and a small amount for one teacher to use in preparing students to take the SAT. Decisions were delayed on a grant that would pay a teacher's tuition and book costs to take advanced degree courses and one that would pay a teacher for curriculum preparation. Requests for the $300 mini-grants designated for classroom improvement exceeded available funds. In response to grant proposals for the purchase of classroom sets of scientific calculators and graphing calculators, the Advisory Committee decided to purchase four graphing calculators and as many of the scientific calculators as possible. Three schools will share the scientific calculators, in addition to calculators remaining from a workshop. As a result of a decision to distribute the mini-grant money as broadly as possible, requests were denied from one school where several teachers had already received grants.

The DMC plan for permanence assigns to the Steering Committee primary responsibility for initiating and implementing activities that will, in time, empower teachers to assume ownership of the collaborative. The committee is composed of 16 teachers, at least one from each school; of those, 14 are women and 2 are men. In addition, Helen Compton and Barbara Davis attend the meetings. The 1989-90 Steering Committee included six teachers from the previous year and ten teachers new to the committee. Two schools have two representatives who alternate attendance at committee meetings.

The Steering Committee met five times during the year, including an all-day planning retreat in May. Ten to 13 teachers attended each meeting. The range of topics discussed in the meetings included: the network sessions; workshops during the year; teacher and business partners; communication within the collaborative; networking between the computer laboratories; DMC Day on April 26, 1989; spring activities; and the Teacher Resource Center. The Steering Committee decided to sponsor a Math Fair during 1989-90, and identified six nominees to attend the EDC Teacher Leadership conference in August. Dr. Compton will make the final selection of the two teachers, ensuring that there is a representative from each school district.

The May planning retreat was held from 8:30 a.m. to 3 p.m. May 25, at the National Humanities Center. Fifteen people attended, including 13 teachers, two of whom also serve on the Board of Directors. A primary purpose of the retreat was to involve teachers in collaborative planning processes. Outcomes from the day included a list of 18 goals; they included raising professional standards, providing teachers with opportunities for collegiality, and empowering teachers to assume responsibility for their own professionalism. Other outcomes of the retreat included a list of possible topics for an August mini-conference; suggestions for a Math Fair; suggestions for speakers and topics for a fall 1989 reception; and suggestions and topics for subject-area networks.

## D. Project Activities

The Durham Mathematics Council offered a variety of activities to mathematics teachers during the 1988-89 school year to foster teachers' professional growth. In addition to these activities, the Council provided support for activities sponsored by other agencies, including financing teachers' attendance at regional and national conferences and workshops.

## Receptions

### Third Annual Glaxo Reception

On September 28, 1988, the collaborative sponsored a kick-off reception for the new school year. All members of the Durham Mathematics Council, including mathematicians from industry and higher education, were invited to attend the event, which was hosted by Glaxo Incorporated. The theme of the reception was Teacher Professionalism, with featured speaker Gail Burrill addressing "A Teacher As A Professional--the Challenge." Ms. Burrill is a mathematics teacher in Wisconsin, director of the Quantitative Literacy Project II, a member of the Mathematical Sciences Education Board and a candidate for the NCTM Board Directors. Nearly 90 teachers, administrators, and university and industry representatives attended the event, which was held at Research Triangle Park.

All of the participants enjoyed the lecture and were most complimentary about the event. One teacher commented, "It was good to see one of us, a classroom teacher, as the recognized authority. The suggestions made sense and will be usable. This was a very worthwhile activity and I would not change a thing about it." Another teacher added, "Ms. Burrell is a charismatic speaker. After hearing her, I have fewer reservations about the proposed curriculum changes. I intend to try to use more manipulatives in my classroom. A most relaxing, informative and enjoyable session." A third teacher remarked, "All of the attention at Glaxo made me feel special. I thoroughly enjoyed the speaker. She was inspirational. After a rather rough start of the school year, I needed this." The Regional Mathematics Director from the North Carolina Department of Education said, "I am most impressed. I would like to extend the ideas and activities of the Durham Mathematics Council throughout the state. As a new person on the state level, I am delighted with what you do here. This was an excellent meeting." The Director of GTE commented, "An excellent program. I was overwhelmed to hear all that Ms. Burrell does. I cannot see how. The enthusiasm of the teachers was outstanding."

### Recognition Reception

On December 9, the collaborative sponsored a reception to honor Ms. Wallis Green, the recipient of the Presidential Award for Mathematics in North Carolina for 1988. Ms. Green, who is a mathematics instructor at Jordan High School, and an active member of the Durham Mathematics Council and the Triangle Math Club, will receive a $5,000 grant from the National Science Foundation to be used in her department.

Forty-six people, including several representatives from business and higher education, attended the reception, which was held in the Watts Lobby of the North Carolina School of Science and Mathematics. The on-site observer reported that the reception was lovely.

## Local Workshops

### Statistics/Data Analysis

The collaborative sponsored a five-day workshop, Statistics/Data Analysis, July 11-15, 1988. The event, which was held at NCSSM, was funded by the National Science Foundation through the NCSSM Outreach Program. The four workshop leaders included two DMC teachers and guest speakers Dr. John Schoenfelder of Glaxo, Inc. and Ms. Marie Eldridge, Director of the Center for Education Studies. All mathematics and science teachers from the area were invited to participate and 23 attended; the DMC paid the $55 registration fee for the six participants who were collaborative members.

Topics addressed during the week-long workshop included: Introduction to Quantitative Literacy, Exploratory Data Analysis, Descriptive Statistics, Correlation, Probability, Chi Square Simulation, Sampling and Surveys, Confidence Intervals, Computer Software, German Tank Problem, Queuing Simulation, and the Misuse of Visual Display of Data. Also included throughout the week were discussions relating statistics to industry, medicine, business and government.

The teachers were very enthusiastic about the workshop. The on-site observer reported, "The participants were literally raving about it. Many were not DMC people and had never been exposed to the things we do. They were overwhelmed at how great we are." In evaluating the workshop, a department chair commented, "Clear objectives, excellent teachers, well prepared lessons, interesting and relevant material, speakers were very good. A week-long workshop was just enough. More teachers need to attend a workshop of this type. It made me aware of useful items to use in class, helped refresh my skills and gave me ways to interest students in statistics." A teacher added, "This is the first workshop I've attended sponsored by DMC. You have done an excellent job. It is heads above workshops I have attended as school in-service. The instructors, materials, special speakers and variety of activities minimized boredom." Another teacher said, "I felt that this was one of the most worthwhile workshops of those I have attended in North Carolina. The instructors, Susan and Joan, were very well prepared. They provided material for use in my classroom and made us feel comfortable in class and in asking questions. The two guest speakers were great." Another remarked, "This workshop gave us, in addition to a great deal of knowledge, a real enthusiasm for teaching statistics. The instructors were very well prepared. This was a great class. I strongly suggest repeating it for others." After praising how well the team of teachers worked together, a department chair said, "Keep at it--the word about you [DMC] is getting out."

## Texas Instrument--Math Explorer Calculator Workshop and Follow-Up

On January 10, 1989, the collaborative sponsored a workshop at NCSSM on the use of the new TI-Math Explorer Calculator. Dr. Gary Bitter of the Arizona State University led the day-long workshop, which focused on using the calculator itself as well as classroom applications. Two classroom sets of the calculators had been ordered by the collaborative and are available for checkout through the DMC Resource Center.

Twenty-six middle school and basic mathematics high school teachers, as well as two administrators, attended the workshop. Substitute teachers were provided through the substitute allocation that the districts had made to the DMC. Participants were given the option of applying for one CEU credit. To receive the credit, a teacher had to prepare a one-week lesson plan implementing the use of the calculator in the classroom and attend a follow-up discussion session that was to be held after school one day in February.

Comments about the workshop were very favorable. One teacher said, "I found the event very worthwhile. The presentations of methods for use in the classroom were excellent. The presentation of rationale for use of calculators in the educational process was a strong point. The material was relevant and most timely." Another commented, "I gained ideas for journal entries and some math test bonus problems. I enjoyed the opportunity to share ideas with other teachers . . . ." A third teacher remarked, "We got excellent material to take back to the classroom . . . . Let's have more events during the school day as opposed to after school." The assistant to the State Director of Mathematics said, "An excellent program. You folks are doing a great job. Wish we could offer such programs to all mathematics teachers in North Carolina."

On February 9, six teachers who wanted to receive continuing education credit for the January workshop met to share the lesson plans they had developed using the materials from the TI Math Explorer workshop. The teachers felt that the session was very worthwhile. One teacher said, "This was a timely session, each of us had had an opportunity to use the material with our students before the follow-up. There was a broad range of uses and all of them were relevant. I wish that we could make a more flexible schedule for such meetings as this." Another teacher commented, "The many uses of this calculator and the special help in finding good uses for it will be most valuable to me. I want to thank DMC for arranging for us to get renewal credit for these workshops. They are much more relevant than those provided by the school systems for all teachers."

## Mathematics Manipulatives Kit Workshop and Follow-Up

On February 23, from 8:30 a.m. to 1:30 p.m., the collaborative sponsored a workshop on the mathematics manipulatives kits that had been distributed to each school. The kits provide a new view of teaching middle school mathematics and basic mathematics on the high school level. The workshop, which was held at the North Carolina Mutual Life Insurance Company, was scheduled to end at 4 p.m., but was shortened due to inclement weather. The goal of workshop leaders Ann Hart, Mathematics Coordinator for Region 3 of the North Carolina Department of Public Instruction, and Pat Sickles, Durham Middle School mathematics teacher, was to instruct teachers in the use of manipulatives and encourage them to use the materials in their classrooms. In addition to providing the site for the workshop, North Carolina Mutual Life Insurance Company provided lunch to the 28 teachers who participated. Substitute teachers were provided through the substitute allocation that the districts had made to the Durham Math Council, so that the teachers could be free to attend the workshop. Participants were eligible to receive one CEU credit by preparing several lessons that incorporated the use of the manipulatives and by attending a meeting with other interested teachers to discuss the lessons.

The workshop was very successful. The on-site observer reported, "This was an excellent program. The participation and enthusiasm of the teachers was outstanding . . . ." One teacher commented, "I found this to be very helpful. It was the most fun 'training' thing I've ever attended. It was a needed workshop and it was well done." Another teacher said, "The presentation was well organized. The facilities were good. The program addresses my needs and was related to practical application. I was able to act as a student and see exactly how to make the most productive use of the manipulatives. I plan to use them now that I can see their value." A third teacher remarked, "Pat and Ann made a work session a lot of fun. I only wish that we could have had our full day. I have had great reservations about the use of these manipulatives with the average-to low-ability student because of potential behavior problems but the techniques presented by Pat will eliminate that possibility."

A follow-up session for teachers who wished to earn continuing education credit was held on April 20 from 3:30 to 6 p.m. Six teachers, the collaborative executive director and her assistant attended. The teachers seemed to appreciate having the opportunity to discuss the lessons they had developed. One teacher said, "Very worthwhile. Good to share experiences . . . ." Another commented, "I learned a lot that I did not know. Many questions that I had about manipulatives were answered." A third teacher added, "I really needed the credit and it was good to have a worthwhile means of getting it. Most of what is provided by the system is useless."

## IBM Toolkit Workshop

On May 11, from 8:30 a.m. to 3:30 p.m., the collaborative and IBM co-sponsored a workshop on using the new IBM Mathematics Exploration Toolkit. The event, which was held at the IBM Corporation Building, was open to the first 20 teachers to apply, but because of the positive response, the limit was removed and 27 teachers, including three non-collaborative teachers, attended. Substitute teachers for DMC members were arranged through substitute days allocated by the district for DMC use.

Arrangements for the workshop had been made by Mary Jo Didsbury, an engineer from IBM and member of the DMC Board of Directors. Brenda Horrigan of IBM presented Algebra and Geometry software, and Dan Teague of NCSSM offered an overview of the IBM Toolkit software. Twenty networked computers were available for the participants to use during the workshop. Lunch was provided by IBM.

Comments from the participating teachers were mixed. Most teachers recognized that the software was interesting and useful, but felt that the time allocated for hands-on training was insufficient. One teacher said, "Excellent software, all-inclusive instructions for use in upper-level math courses and time to explore. Instructions were not included for algebra and geometry. The event was beneficial but make sure teachers have time to explore. Plan a series of workshops where we get to share ideas and info gathered from the events we have attended this year. The time was good but we needed more time to explore on our own." Another remarked, "The event was well organized. The presenters were well prepared and very knowledgeable. The presentation held my interest from start to finish. We were introduced to some very useful contacts. I desired more time for exploration on my own. I enjoyed the workshop very much and I hope to attend more of them in the future."

### Site Visit to Media Evaluation and Review Center

On January 12, two collaborative teachers visited the Media Evaluation and Review Center in Raleigh, North Carolina. Originally four teachers had been scheduled to visit, but two had to cancel. The teachers spent the day with Ann Hart, Regional III Mathematics Director, evaluating software and learning about the services of the Center. The Center publishes a monthly advisory list of instructional media in all areas, containing evaluations of all the newest materials including books, software, videos, filmstrips and workbooks. The two teachers reported that the visit was very worthwhile. They were excited about their discovery of the Center as a valuable resource, and identified three software programs--Algebra Shop, Math Shop, and Mission Algebra--that seemed especially promising. In a letter to the collaborative's executive director, one of the teachers wrote " . . . Thank you for the opportunity to discover these resources and services. I will be sharing my information with our Math Department and other teachers at future meetings . . . ."

### Follow-Up to the NCSSM 1987 Summer Workshop

In July, 1987, the Mathematics Department of the North Carolina School of Science and Mathematics, with input from the DMC, conducted a 12-day workshop on the new fourth-year mathematics curriculum being developed by the department. The course stressed an applications approach to the study of precalculus and covered six modes of mathematical thought: geometry, data analysis, probability and statistics, mathematical modeling, computers, and finance.

Teams of teachers from nine of the UMC projects, including four teachers from the DMC, attended. Each team of teachers that participated was expected to pilot test some of the newly designed instructional units during the 1987-88 school year; conduct a one-week workshop during the summer of 1988 for teachers of grades 7-12 in their home district; and participate in two follow-up meetings, one in 1988 and one in 1989, to share their experiences and ideas and to suggest ways to implement the materials. The workshop, as well as the follow-up sessions, were funded through a proposal submitted by NCSSM to the National Science Foundation.

The second follow-up workshop was held February 16-18, 1989, at the NCSSM. Of the four DMC members who had participated in the summer workshop, only two were able to attend the 1989 follow-up workshop. The two teachers who participated praised it highly. One said, "The follow-up was great. It was amazing to see how much the other teachers had grown since the first time we met. I hope that I have grown as much as they. I got some wonderful ideas that I am anxious to use in my classes. The sharing sessions were most valuable. This was a marvelous opportunity for me to learn a great deal and I am grateful." The other teacher commented, "The session on the graphing calculator was particularly good. The sessions on mathematical modeling were also superior. In fact, everything about the workshop was marvelous. It was so good to see all of the teachers again and to share what we had done with what we learned at the 1987 workshop. This bringing together of teachers from across the nation may well be the answer to the implementation of the Standards."

## Subject Area Networks

These teacher-generated subject-area networks are an important support vehicle that emerged as an outgrowth of DMC activities. The networks provide teachers with opportunities to meet in small groups to discuss issues and to share information on specific subjects that are of interest to the participants. The networks meet at NCSSM. The meetings, which are planned by the teachers, are publicized through the DMC newsletter and special bulletins mailed to all mathematics teachers.

Networks had been established for Algebra II/Pre-Calculus, Geometry, and Middle School Mathematics. (An attempt to begin a network for teachers of Algebra I was unsuccessful.) During the 1988-89 school year, additional networks were established for Calculus and Basic Mathematics. This year, for the first time, one continuing education credit was offered to teachers who participated in the Algebra II/Pre-Calculus, Geometry, or Middle School Networks. To participate for credit, teachers were required to attend all of the network meetings in their subject area, adapt new ideas in their classes, and meet at the end of the year to evaluate the program.

## Algebra II/Pre-Calculus Network

The Algebra II/Pre-Calculus Network, which was established in spring, 1986, was the first of the networks to be formed. It is designed to bring together city and county teachers of Algebra II, Algebra III, Pre-Calculus and Calculus to share ideas and to help one another with problems.

This network met five times during the 1988-89 school year: November 1, December 6, February 7, March 14, and May 9. Overall, the series of network meetings focused on the use of the Sharp EL5200 Calculator and spreadsheets in the classroom. Topics addressed at individual meetings included using the Sharp Calculator as a teaching tool, solving simultaneous equations with the Sharp, curve fitting on the Sharp, exploring the use of the spreadsheet as a teaching and record-keeping tool, and spreadsheets as a "hands-on" exploration tool for teaching geometry and algebra. Most of the sessions were led by DMC teachers, with attendance at the meeting generally ranging from six to 11 teachers; in May, however, tornadoes limited participation to only three teachers.

The teachers who participated in the network seemed to find it valuable. They were pleased not only with the content of the sessions, but with the opportunities for collegiality. After the first meeting of the school year, a teacher commented, "The program was quite good. The handouts were excellent. Working with those who were more familiar with the calculator was a good move. We can teach each other a great deal. Those of us who know very little about the calculator are looking forward to the next meeting where we can see actual classes taught using the calculator." Following the December session on matrices, a teacher said, "It is very helpful to have hands-on experience with the calculators rather than to try to figure out the manual. I learned a great deal and am prepared to show my students how to manipulate matrices with the calculator." Another added, "This was very worthwhile to me. The diagrams of the calculator keyboard were great. Permission to duplicate them is a great Christmas gift."

Teachers' reactions to other network meetings have been equally positive. Comments have included: "I really benefit from all of the DMC activities. All of my experience with this calculator has come from such events. I would never have been able to teach it to my class without these experiences"; "This workshop was excellent and very informative. It fits my needs very well. I plan to do my grades this way next term. I thought the comparison between the Apple and IBM was great. DMC really offers us a great opportunity to explore and learn about new and unused technology."

## Geometry Network

The Geometry Network was formed during the 1986-87 school year to address issues and techniques related to the teaching of geometry. Although the network got off to a slow start, meeting only once in 1986-87 and once in 1987-88, the network met five times during the 1988-89 school year: October 27, November 29, January 12, February 2, and April 18. Topics addressed at the individual meetings included new approaches to geometry with a focus on hyperbolic geometry, pentominoes, and the State Department's end-of-course geometry test. The November meeting featured a SWAP and Copy Sharing Workshop, during which teachers shared materials that they have used or developed to teach geometry. As with the Algebra II/Pre-Calculus Network, most of the presentations and discussions were led by DMC teachers; in April, however, Dr. Robert Jones, Head of the Mathematics Division of the State Department of Public Instruction, met with the members of the network to discuss end-of-course testing. Attendance at each of the meetings ranged from four to fifteen teachers.

Response to the Geometry Network was very favorable. Following the October meeting, during which a DMC teacher discussed a new approach to geometry, one teacher commented, "Good handouts, good speaker. The level of success of students was the main emphasis. The program helped by showing ways we can help students apply critical thinking skills through learning geometry intuitively . . . ." Another said, "Enrichment topics for teachers are needed--we don't know everything. The idea of hyperbolic geometries in high school geometry to emphasize attributes of Euclidean geometry sounds great. I've always wondered how to do it . . . ." Teachers were equally enthusiastic about the January network meeting, during which a DMC teacher introduced pentomino puzzles. One teacher commented, "This was an excellent program. It would really give students a real feel for area and perimeter. The handouts Vivian gave us will be most useful. I plan to use them on Fridays. It is so good to find new ways to motivate students and make them believe that geometry can be really fun."

In particular, teachers seemed to appreciate the two sessions dedicated to discussions of the end-of-year state testing of geometry. They expressed concern about the type of testing that is done. One teacher said, "The event was very informative since I knew very little about the test. It was nice to hear the concerns of others. I learned a lot from the discussions. I would have liked to learn more about the other part of the test, perhaps we can do that at a later meeting." Another commented, "The differences in viewpoint of what is important in geometry were brought out . . . . I am looking forward to hearing the state department representatives try to reconcile this test to the implementation of the Standards."

After the meeting with Dr. Robert Jones, a teacher said, "Very enlightening, especially on bureaucracy in the state and the quality of political interest. A very beneficial meeting. I feel better about what we can do to change things now that Bob [Jones] has told us what paths to follow." Another said, "There are too many discrepancies on the purpose and teaching of geometry and what should be tested. I think that because of this we are frustrated!! As for me, the Standards tell me what is needed for the student to learn. I need this, but creativity needs to be allowed. There is not enough time to do everything and still do all of this testing." Dr. Jones commented, "Durham Mathematics Council has done a lot for you and all of you would probably teach all of the objectives in your own way. The testing is designed to see that all teachers cover all of the necessary material. I tried very hard to convince the testing committee that we should not try to test geometry until the course was better defined by the Standards but to no avail."

## Middle School Mathematics Network

During the spring of 1987, many teachers expressed interest in forming a network for mathematics teachers of grades 6-9. Because considerable recruitment work was necessary, however, the Middle School Mathematics Network was not established until the 1987-88 school year, during which five meetings of the network were held.

The Middle School Mathematics Network met three times during the 1988-89 school year: October 17, December 8 and April 4. Another meeting set for February 14 was cancelled due to scheduling conflicts.

On October 17, the teachers in the Middle School Mathematics Network met with John Goebel, a mathematics teacher at NCSSM, to discuss the MATHCOUNTS contests. The

20 teachers who attended seemed very enthusiastic about coaching MATHCOUNTS teams. One teacher commented, "I found the event very worthwhile. We got excellent information on the special topic for the 1988-89 MATHCOUNTS tests. There were good examples and suggestions. We need more time to discuss ways to incorporate MATHCOUNTS at the school level. DMC is a great opportunity. Thank you for including middle school teachers." Another added, "John's instruction was clear and concise. I have always had a MATHCOUNTS team, but I feel much better prepared to coach this year. The coaching assistance provided by DMC will not only make my task easier, but should also make our team more successful."

The discussion of mathematics contests continued at the December 8 meeting of the Middle School Network. Chuck Stewart, a teacher from Culbreth Junior High, informed the nine participating teachers and administrators about the sixth grade contest sponsored in Chapel Hill. The on-site observer reported that everyone was enthusiastic about the possibility of initiating a similar program in the Durham schools.

One teacher commented, "I got some very helpful information relevant to both the MATHCOUNTS contest and the sixth grade Quiz Bowl. I hope to help start such a program for Durham City/County schools." Another added, "I found the meeting most worthwhile. We need to have a device to challenge students to do their best on the sixth-grade level. The materials and helpful hints will be used at my school right away in preparing for the MATHCOUNTS competition." A third teacher remarked, "Chuck gave us some great ideas. The steps to getting the sixth-grade program started were spelled out in detail. I only wish that we had more time to get into his program of coaching coaches."

The third and final meeting of the Middle School Network for the 1988-89 school year was held on April 4 at NSCCM. Two teachers, the collaborative coordinator and the on-site observer participated in a group evaluation of Apple and IBM software for the middle schools. The discussion was led by Ms. Christina Lecky, a teacher from Lowe's Grove, a county middle school.

The attendance was significantly lower than had been anticipated; many county teachers attended a meeting scheduled simultaneously, and most city teachers took advantage of an opportunity to meet the new superintendent. The two teachers who did participate felt that the session was beneficial and reported that they would be able to use some of the software in their classes. One teacher said, "I discovered much software of which I was unaware. I checked out the graphing equations to use in my class this week.

I found this to be a most worthwhile session and am sure that the other teachers will be able to use the things we have recommended as a result of this evaluation." The other teacher commented, "It was good to be able to use the various programs and to find that some of them are worthwhile while others are not. This will enable the middle school teachers to save a great deal of time in evaluation. I wish that more people had been able to attend. We learned a lot." The on-site observer felt that the session was a good way to introduce middle school teachers to available software and suggested that another session be scheduled when more teachers could attend.

### Calculus Network

A network for teachers of calculus was established during the 1988-89 school year to provide calculus teachers and others interested in calculus with an opportunity to share different teaching methods and present various points of view regarding calculus instruction. The network met twice during the year.

The first meeting of the Calculus Network was held November 17 at NCSSM. All calculus teachers from both the city and county systems were invited to participate, and seven of the eight attended the opening meeting. The first meeting focused on preparing students for the Advanced Placement exam and how the exams are graded.

The on-site observer reported that the session was stimulating and that all of the participants contributed to the discussion. One teacher commented, "It is very worthwhile to meet with others who have exactly the same problems that I have. The idea of subject matter networks seems to me to be the most useful of our activities." Another added, "Good session. We must get our act together and this sort of meeting helps a great deal."

The Calculus Network met again on December 15 at NCSSM to review and share available software. The session also provided the teachers with an opportunity to become better acquainted. The four teachers who attended seemed to feel that the session was very worthwhile. One teacher commented, "I am excited about the possibility of working with other calculus teachers. Perhaps we can work together to make transfers of pupils easier for both students and teachers. Software was shown that can be used on both Apple and IBM; this was a good idea as we have no IBMs at my school. I plan to check out software from our resource center to use in my classes." Another added, "A worthwhile session. It was most helpful to see how others use Arb Plot and the IBM Mathematics

Exploration Toolkit in instructional settings and how they are used by students on their own." Rather than holding any more formal meetings, the five calculus teachers communicated with one another by telephone and through the inter-school courier during the remainder of the school year.

### Basics Network

During the 1988-89 school year, a network was formed to serve mathematics teachers who focus on non-algebraic skills. Both middle school and high school teachers were invited to participate in the network, which met twice during the school year.

The first meeting of the Basics Network was held November 22 at NCSSM. Discussion focused on how to use computers and calculators to motivate students in solving problems. Only four teachers attended the meeting; the on-site observer attributed the poor attendance to the Thanksgiving holiday and the need for teachers to turn in students' grades. Participants reported that the meeting was most interesting and productive, that the network was very worthwhile, and that they were going to encourage other teachers to become involved.

The second meeting of the Basics Network was held December 15, 1988, at the NCSSM. The meeting was designed to give teachers an opportunity to review and share software, as well as to become better acquainted. While only four teachers attended, a smaller turnout than anticipated, the on-site observer reported that the participants enjoyed sharing ideas and discussing solutions, and were very involved in the activity. Those in attendance seemed grateful that DMC had initiated a Basics Network. One teacher commented, "I am glad that DMC is finally recognizing that all high school math is not college prep. Our students have been neglected for a long time by all aspects of the educational system. It is good to discover that there is money available to purchase software to use in my classes. I plan to begin using the computer more." Another teacher said, "I was disappointed that so few of us attended this session. We will have to talk it up and get better attendance." A third teacher added, "It was most worthwhile to share philosophy with the other basic teachers."

Instead of meeting as a separate group for the rest of the year, these teachers attended the Manipulatives Workshop, the Texas Instrument Math Explorer Workshop, and some of the meetings of the Middle School Math Network.

## DMC Resource Center

The Teacher Resource Center was established in spring of 1987, in office space provided by NCSSM. The Center, which is open between 8 a.m. and 5 p.m. weekdays, serves as a work place for teachers outside of the school site, and also provides teachers access to computers, software, videotapes, calculators, manipulatives and texts and supplemental materials.

The Center provides classroom sets of TI Math Explorer Calculators and Sharp EL-5200 graphing calculators that teachers are encouraged to check out. At the end of March, IBM donated an IBM System 2 computer to the Center. DMC added an overhead projection monitor to the system (which includes a hard disk, printer and internal modem) and plans to loan it to various schools so that teachers can use it in their classrooms for an extended period of time.

An inventory of all the materials in the Resource Center was started in the summer of 1989 and is due to be completed in the fall. A copy of the resource list will be distributed to each school through the members of the Steering Committee. Information about new materials acquired by the Resource Center is published in the DMC Newsletter, and teachers are continually encouraged to use the Center's resources.

## Triangle Math Club

The Triangle Math Club, an organization designed to involve mathematicians from all sectors and to promote the growth of mathematics and mathematics education, was formed during the 1986-87 school year. The club, which is modeled after the Chicago Metropolitan Math Club, provides an opportunity for all persons interested in mathematics from Durham and the surrounding Triangle area (Wake, Durham, and Orange counties) to meet in a social setting and to listen to and interact with one another and with invited speakers on various mathematical topics. The quarterly dinner meetings are planned by a seven-member planning board. While the Triangle Math Club is partially funded by the DMC in that clerical support and mailing are provided by the collaborative, most of its revenue is derived from its $8 annual membership dues; these funds cover the cost of honoraria for the speakers. In addition, DMC also helps to identify speakers and to disseminate information on club meetings and activities.

The Triangle Math Club held four dinner meetings during the 1988-89 school year: September 20, November 15, February 16 and May 18. Participants paid for their own meals.

## September 20 Meeting

The first meeting of the Triangle Math Club for the 1988-89 school year was held September 20, 1988, at the T.K. Tripps Restaurant, located between Durham and Chapel Hill. Dr. Kevin Bartkovich, instructor of mathematics at the North Carolina School of Science and Mathematics, spoke on "Mathematics in an Election Year." Only 21 teachers and one representative from industry attended the meeting, which was fewer than anticipated.

Those who were present enjoyed the evening. One teacher commented, "An excellent session. One of our more interesting meetings. The handouts were great. The ideas were timely and most interesting. Our time schedule worked out better than last year. I learned a great deal and can use most of the information in my classes as both motivational and instructional materials." Another added, "A very enjoyable evening, one of the best I have attended. The topic was very interesting, intellectually stimulating. The handouts and visual aids were excellent. The atmosphere was very friendly. We need to have more time and be encouraged to mingle." A scientist statistician from Glaxo, Incorporated remarked, "The presentation was interesting, relevant and well reasoned. I would be interested in talks on linear algebra and its physical applications at future meetings. We need to spread the word and get more folks involved."

## November 15 Meeting

The Triangle Math Club held its second dinner meeting of the year on November 15, 1988, in the American Tobacco Dining Room at NCSSM. Dr. William Love, professor at the University of North Carolina at Greensboro, spoke on "Fractals, the Frontier of Mathematics." Twenty-seven club members, including seventeen teachers, four university representatives, and a representative from the Department of Public Instruction, attended; each participant paid the $7 cost of the dinner.

Those in attendance seemed to enjoy the presentation, the dinner, and the opportunity to meet with other colleagues. One teacher commented, "Great opportunity to meet with others interested in different mathematics. Dr. Love was wonderful as usual. The video pictures were truly awe inspiring. A most worthwhile evening." Another said, "An evening of intellectual stimulation is most welcome after spending the day with basic math classes. As a first year teacher, I feel that nothing I learned in university math classes is being used. If it were not for meetings such as this, I am not sure that I would stay in the profession. I so often feel that I am accomplishing nothing what with absenteeism, poor discipline and personal problems of my students." A third added, "I knew nothing of fractals when the flier about this meeting arrived. I came out of curiosity and stayed after to find out more about the subject. Dr. Love recommended several books I can read. I intend to explore fractals in much greater detail, particularly since I have access to computers." The representative from the Department of Public Instruction said, "The Triangle Math Club is among the best things that the Durham Mathematics Council has established. Here you have member teachers who come because of a genuine interest in mathematics."

### February 16 Meeting

The third meeting of the Triangle Math Club for the 1988-89 school year was held February 16, 1989, at the Lizzard Lick's Restaurant in Durham, North Carolina. Ms. Wally Green spoke on "What You've Always Wanted to Know About the Cubic Formula and Were Afraid to Ask." Ms. Green, a mathematics instructor at Jordan High School in Durham and the winner of the 1988 Presidential Award for Excellence in Science and Mathematics Teaching in North Carolina, had participated in a seminar on the historical context of mathematical theorems at Ohio State during the summer of 1988, and much of her presentation was devoted to sharing what she had learned. Forty-four people attended, including the 21 teachers from the other ten collaboratives who were participating in the NSF program at NCSSM.

The presentation was well received, and everyone seemed to appreciate having the opportunity to talk with one another. One teacher said, "A most worthwhile event. Wally did a great job of mixing humor, history and mathematics. She held the attention of all. I enjoyed meeting and having enough time to speak with other teachers from both systems and those from other places." Another commented, "I enjoyed seeing other teachers and getting to visit with them. The talk was very enjoyable and entertaining. Wally did a great job. The food was good, the service was good and it was a most pleasant evening." A third teacher added, "The program was excellent. Wally was very well prepared, interesting and entertaining. The handout will also be helpful. The dialogue was great and the purpose of the meeting was carried out." A teacher from San Diego remarked, "Better than worthwhile, it was excellent. This material will get used in my classes. I have often been asked for practical applications of complex numbers. This is a fun area!" The mathematics supervisor from the Durham City Schools said, "The speaker was extremely interesting and entertaining. The topic was very interesting. I like the way it was presented and the humor with which it was delivered was delightful. I thoroughly enjoyed the evening."

### May 18 Meeting

The Triangle Math Club held its last dinner meeting for the 1988-89 school year on May 18, at Shoney's Restaurant in Durham. Dan Teague, instructor of mathematics at the North Carolina School of Science and Mathematics, spoke on "Modeling Dynamic Systems Using Stella Software." Only ten people attended the dinner. The relatively low attendance was attributed to insufficient publicity and conflicting schedules at a very busy time of the school year.

Participants included three collaborative teachers, four non-collaborative teachers, one representative each from higher education and industry, and the on-site observer. The on-site observer reported that everyone who attended seemed to enjoy the presentation and became involved in the discussion. One of the teachers commented, "Very interesting. I would like to try to use this with my students. I really enjoyed the fellowship of others who are interested in mathematics." Another added, "Dan did a fine job of presenting the program and in illustrating what Stella can do in predicting the future of various situations. A good session. It is a pity that more were not there."

### Grants

The Durham Mathematics Council offered funding to secondary teachers in Durham City Schools or Durham County Schools through its travel grant, grant and mini-grant programs. Funding also was available to Durham teachers through the NCCTM mini-grant program. In addition, the Durham Math Council provided clerical support to teachers to assist them in applying for grants awarded by other agencies.

## Travel Grants

The Durham Mathematics Council awarded funds to teachers to attend state and national meetings, to participate in workshops, and to visit schools with model programs. These grants were designed to provide teachers with the opportunity to become familiar with national issues in mathematics. In allocating the travel funds, the Advisory Board assigned highest priority to those programs that would enable teachers to bring back information to share with other teachers. In addition to transportation costs and registration fees, funds also were available to pay substitute teachers.

During the 1988-89 school year, the DMC awarded 45 travel grants to enable teachers to attend a variety of state, regional and national conferences and institutes; they included the Statistics Workshop at NCSSM, the Carolinas Mathematics Conference in Charlotte, the Microcomputers in Education Conference at Arizona State University, the 5th Annual Mathematics and Computer Conference at Phillips Exeter Academy, and regional and national meetings of NCTM.

## Grants

DMC's grant program is designed to support two key activities of its members: university study in mathematics and teachers independent work in mathematics during the summer. The collaborative awarded grants totaling $1,382 to three teachers during the summer of 1988. Two of the teachers took courses at the University of North Carolina-Chapel Hill and the third teacher attended a summer institute at the University of North Carolina-Charlotte.

A small number of grants were also available to provide teachers with up to one month's salary during the summer to pursue an area related to the goals of the collaborative, such as curriculum or materials development. These grants are awarded on a competitive basis, with special consideration given to projects aimed at groups that are traditionally underrepresented. During summer 1988, the DMC provided funds to a teacher who worked for two weeks to collect and develop games to reinforce arithmetic skills for middle school students. Two other DMC teachers received funding for two weeks to review videotapes, and to explore and document materials for the use of the Sharp calculator. The three packets of materials that they produced as a result of their work are available to teachers through the DMC Resource Center. Another teacher was granted $1,447 to work two weeks during the summer and to conduct a workshop during the school year. A $200 grant was awarded to a teacher to purchase materials to help prepare students for SATs, and a grant of $1,200 was awarded to a teacher for curriculum development. One county school teacher received $2,823 to work on a computer programming course, with two others who had received funding through their own school systems. Another teacher received $500 to attend an Advanced Placement Workshop at UNC-Charlotte, and another was awarded $350 for summer study at UNC-Chapel Hill. In May, 1989, the collaborative awarded two grants totalling $4,298 to two teachers to develop a resource manual for geometry that is to be completed by the end of summer 1989 and then added to the Resource Center's collection.

## Mini-Grants

DMC's Mini-Grant Program supports innovative efforts to enrich and strengthen the mathematics curriculum in the Durham city and county schools. These grants are designed to encourage teachers to pursue innovative classroom approaches by providing seed money for instructional experimentation and equipment, and for the development of new curriculum and materials. A teacher can apply for a mini-grant of up to $300 for classroom improvement. The funds provide teachers with the resources to pursue new approaches and activities that would otherwise be unexplored.

Grant applications are reviewed and approved by the DMC Advisory Committee. In order to encourage teachers to work together, special consideration is given to projects that involve more than one teacher and more than one classroom.

Approximately 30 requests for mini-grants were received during the 1988-89 school year; of these, 25 were awarded. The majority of requests asked for funds to purchase classroom sets of the Texas Instruments Math Explorer calculator. It appears that these requests are a direct outcome of the presentation that Professor Gary Bitter made to DMC teachers in January, 1988.

## NCCTM Mini-Grant Program

During the 1987-88 school year, the North Carolina Council of Teachers of Mathematics instituted a mini-grant program designed to promote excellence in mathematics education. The program, available only to NCCTM members, was developed to provide funds in each of the three NCCTM regions for special projects and research that will enhance the teaching, learning, and enjoyment of mathematics. An allocation of $1,000 was made to each region, an increase of $500 per region from the previous school year.

The NCSSM faculty offered to assist DMC teachers in preparing their grant applications. Proposals are evaluated by the NCCTM Awards Committee and the elected officers from the three NCCTM regions. One collaborative teacher applied for a grant to purchase graphing calculators, but the proposal was not funded.

## Other Grants

The collaborative offered clerical assistance to three teachers who applied for a Bertelsman Foundation German-American Scholarship. The program, which awards grants of about $3,000, is designed to encourage communication between German and American teachers. Criteria include an applicant's background, experience, interest and adaptability. Two DMC teachers received grants to go to Germany to work with German mathematics teachers for four weeks during the summer of 1989.

A DMC teacher, Ms. Vivian Leeper Ford, was awarded a scholarship from the Woodrow Wilson National Fellowship Foundation to attend a Woodrow Wilson Institute in summer, 1989. The Institute is designed to strengthen the professional status of teachers, deepen their knowledge base, increase concentration on subject matter and encourage use of innovative teaching methods. Criteria included depth of academic background, experience in curriculum development and demonstrated leadership. The collaborative publicized the availability of the scholarship in newsletters, fliers and at monthly Steering Committee meetings, and also provided individual consultation, clerical support, and letters of support to Ms. Leeper Ford.

## State, Regional and National Conferences and Seminars

### Statistics Workshop at NCSSM

The Durham Mathematics Council awarded travel grants totaling $220 to four teachers to support their attendance at a statistics workshop at the NCSSM in July, 1988.

### EQUALS Training Workshop

A DMC teacher from Hillside High School attended an EQUALS Trainers Workshop at UNC-Chapel Hill in August, 1988. EQUALS is a training program with a special focus on attracting and retaining women and minorities in mathematics. The week-long session prepared participants to serve as trainers for EQUALS workshops in their own districts. Activities and sessions were designed to explore ways that classroom teachers could promote equity in high tech careers. The activities presented were designed to appeal especially to girls but are applicable in any classroom and with a variety of groups. The EQUALS approach encourages students to keep their career options open by taking as much high school mathematics and science as possible.

When asked what she found most interesting about the workshop, the teacher responded, "My favorite activity from this workshop was stations. My students and I enjoy solving the problems on display around the classroom. I look forward to sharing this and other activities with DMC teachers."

### Carolinas Mathematics Conference

The North and South Carolina Council of Teachers of Mathematics and the Mathematics Division of the North Carolina Department of Public Instruction jointly sponsored a conference in Charlotte, North Carolina on October 6 and 7, 1988. Featured speakers included Zalman Usiskin, Admiral Grace Hopper, and Shirley Frye.

The Durham Math Council supported the attendance of five city and eight county teachers at the conference, all of whom seemed to have found the conference very worthwhile. One teacher reported, "The Carolinas conference was stimulating and exciting . . . . South Carolina teachers shared a lot of good ideas through their 'Make it, Take it' workshop. I look forward to sharing these ideas with Math Council teachers." Another teacher said, "The conference offered a wide variety of topics in mini-sessions and hands-on workshops. There were several concrete ideas I acquired and have already incorporated some of these into my classroom objectives." Another teacher said, "The trip to the conference was very worthwhile. While there, I presided at a session on geometry for middle school students by introducing the speaker, Mary M. Lindquist. I also attended several other interesting sessions as well as had the opportunity to browse and purchase materials and posters from the exhibits and the 'Make it, Take it' area. I continue to appreciate the support and financial assistance the Durham Math Council has provided me."

## NCCTM Annual Eastern Regional Conference and Math Fair

The collaborative supported the attendance of six DMC teachers at the Eighteenth Annual Regional Conference of the North Carolina Council of Teachers of Mathematics in Greensboro, North Carolina on March 3, 1989. The theme of the conference was "Meeting the Curriculum Challenge . . . . Standards for the Future." As part of the conference, NCCTM and the Mathematics Division of the North Carolina Department of Public Instruction co-sponsored a Math Fair for student projects.

The Durham Mathematics Council awarded grants totaling $387 to allow teachers to attend, with individual grants ranging from $16 to $48. The city and county school systems provided substitutes for the teachers who attended as part of an in-kind contribution to the DMC.

The on-site observer reported that all six teachers felt that they had learned a great deal from the conference and that they planned to use what they had learned. One of the attendees reported, "This kind of conference was helpful in giving me ideas on various topics. I acquired several handouts on 'warm-up' activities. The speakers covered an array of mathematics subjects that were up to date and interesting."

## NCCTM Meeting

An NCCTM meeting was held at Lenoir Community College in Kinston, North Carolina, on March 3, 1989, the same date as the NCCTM Eastern Regional Conference.

Two DMC teachers made presentations at the conference. Neither teacher asked the collaborative for funding.

## Microcomputers in Education Conference

The collaborative sponsored a high school teacher to attend the Microcomputers in Education Conference at Arizona State University in March, 1989. The $900 grant covered travel, accommodations, and registration fees. In return for the funding, the teacher agreed to write an article about the conference for the collaborative newsletter and also to share some of the information at a meeting of one of the networks. The teacher thought that the workshop was very worthwhile and was most grateful for the collaborative support. He said, "I would have been unable to attend this conference without collaborative support. In fact, if it were not for the collaborative, I doubt that I would still be a teacher."

## NCTM Regional Conference

The Durham Mathematics Council offered funding to teachers to attend three regional meetings of the National Council of Teachers of Mathematics. Only one DMC teacher applied, using the funds to attend the Northeastern Regional Conference #1, which was held October 12-14, 1988, in Pittsburgh, Pennsylvania. Among the highlights of the conference were the many outstanding speakers and the 187 special- and general-interest sessions, workshops and labs. Also featured were four mini-conferences on testing for essential learning and literacy skills, developing a diagnostic-prescriptive mathematics program, secondary school mathematics for the future, and effective staff development.

The grant recipient expressed his gratitude to the collaborative for the opportunity to attend the conference. He reported, "I thank the DMC for this opportunity. Many of the presenters there had the same type of students and problems we have and their attempts to solve and correct these problems are very similar to ours. The presenters stressed group discussions, trial and error, and actual hands-on participation for discovery of answers at all class levels."

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Eleven DMC teachers received funding to attend the annual meeting of NCTM in Orlando, Florida, April 12-16, 1989. The theme of the conference was "Vision for the World of School Mathematics." During the day the teachers attended a wide variety of sessions. In the evening, the teachers participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Teaching and Curriculum Program.

The collaborative awarded travel grants totaling $5,953.93 to 11 teachers to cover their travel and hotel expenses, as well as their registration fees. The city and county schools provided substitute teachers. The teachers who attended were selected by the DMC Advisory Board. As part of the grant request form, teachers had to indicate how the meeting would benefit them, and in turn, the DMC.

The teachers who attended were extremely enthusiastic about the conference. One teacher said, "DMC has made it possible for me to attend NCTM for the first time. I feel honored to be selected and look forward to sharing what I learn. The application process was simple and all arrangements were made for me." Another commented, "DMC has done an excellent job of answering questions about the application process, has facilitated our travel, and has assured a pleasant experience by having us meet together before and after the conference." A third teacher said, "DMC was extremely efficient in providing information on all meetings and setting travel, hotel, etc. Most helpful in supplying forms and quickly processing the request."

## Contemporary Topics in Pre-Calculus Mathematics

DMC paid the $105 fee for each of three teachers to attend a one-week mathematics workshop, June 25-30, 1989, at the Mathematics and Science Education Center of NCSSM. The workshop focused on the use of real-world applications and mathematical modeling to motivate and enhance traditional topics in the secondary mathematics curriculum. Use of the computer and calculator as teaching tools was discussed and demonstrated. The workshop also addressed the recommendations of the NCTM Standards to change the mathematics curriculum to reflect recent advances in technology and to enable students to become mathematical problem solvers. Specific topics included data analysis, applications of matrices, and the use of elementary functions in mathematical modeling. The cost of the workshop was $105, which included materials, lunches and breaks.

## Phillips Exeter Conference on Computers and Mathematics and the National Educational Computing Conference

The Durham Mathematics Council sponsored one teacher to attend the Fifth Annual Mathematics and Computer Conference, June 25-30, 1989, at Phillips Exeter Academy in Exeter, New Hampshire. All DMC teachers were offered the opportunity to apply for the travel award, which included travel, registration, and room and board expenses. This teacher also received funding to attend the National Educational Computing Conference, June 20-22, 1989, in Boston, Massachusetts. The theme of the conference was "Connections," and it focused on presenting ideas in the uses of technology to improve educational quality.

After the conferences the teacher commented, "I learned much and came away with a host of ideas and strategies to help make my classes and coursework more interesting and challenging . . . . Thanks again DMC for making this all possible! I am prepared to share software, ideas and printed materials with DMC members."

## Newsletter

Copies of the Durham Mathematics Council's newsletter are sent to Steering Committee members for distribution to their building teachers in the city and county school systems, as well as to mathematics users who are involved in DMC activities, donors, board members, school principals, and district superintendents. The newsletter, which is published approximately nine times during the school year, is a primary tool for disseminating information. The newsletter highlights upcoming activities, provides articles on topics in mathematics and mathematics reform, and offers reports from DMC members (including teachers who have attended conferences) and from the Council's executive director.

## E. Observations

### Project Management

The Durham Mathematics Council, housed in the North Carolina School of Science and Mathematics, offers an interesting opportunity to study the relationship between a collaborative and its host agency. Having the administrative structure of the Durham Mathematics Council embedded in the NCSSM has served the collaborative well, but there are questions about whether the current relationship can or should be maintained. When Dr. Jo Ann Lutz resigned as executive director, the transition to the new executive director, Dr. Helen Compton, went very smoothly. Dr. Compton had been involved with the formation of the collaborative and had been kept informed of its development. As she noted in her first newsletter greetings, "I have watched (DMC) grow over the past three years and have admired your work." Because the new executive director was an employee of NCSSM, it was a relatively easy administrative task to convert her full-time teaching position to one that involved half-time teaching and half-time service as executive director. Another factor in the successful transfer of authority was the high level of esteem with which DMC teachers regard the faculty of NCSSM. This, in combination with Dr. Compton's personal efforts to visit every school and to get to know DMC teachers, resulted in her ready acceptance by the collaborative teachers. Holding two half-time positions within the same organization (and never really being free to relinquish one set of responsibilities to attend to the other) frequently results in a stressful situation. Dr. Compton worked more than half time in each position. Dr. Compton resigned as executive director effective June 1, 1989, in order to return to full-time teaching at NCSSM. Due to members' other time commitments and interests, it appears that there is not a NCSSM teacher who will be able to replace Dr. Compton. Thus, for the first time, the hiring process will have to go beyond the walls of NCSSM. The capability of DMC to hire an executive director of the caliber of the previous ones, who is able to function as they have, will be one indication of the strength and durability of the collaborative.

The NCSSM is also undergoing a change in administrator, with a new executive director scheduled to start in July, 1989. The impact this will have on the collaborative is unknown. The former NCSSM director was strongly committed to the collaborative, but it is possible that a new administrator may question the close link between NCSSM and the collaborative. This situation is not unique to DMC; it has been an issue in nearly all collaboratives in which there has been a change in personnel. A key factor in these transitions has been the existence of a person or group, such as a board, that is able to guide the collaborative through the inevitable changes it will experience over time. The Durham Mathematics Council has two stabilizing influences in collaborative director Dr. Keith Brown and an active Board of Directors. With the changes that the DMC is facing, the 1989-90 school will be a critical year in the collaborative's development.

The governing structure of the DMC remains solid. The Board of Directors, which as a group is very supportive of the collaborative, consists of representatives of all sectors--schools, business, and higher education. It meets regularly with good attendance, and it addresses issues critical to the collaborative's survival and continued growth. Board members also serve as resources to the collaborative, as in the case of several board members who have offered partnerships from their businesses. The board has a well-defined, efficient committee structure so that the tasks are dispersed among a variety of subgroups, including the Advisory Committee, the Finance Committee and the Steering Committee.

## The Advisory Committee

The Advisory Committee assumes a vital role in allocating funds for travel, grants, and mini-grants. In the early years of the collaborative when the funds exceeded the requests, the committee did not have so many decisions to make. Now, as the number of requests outnumbers the funds available, the committee has become more formal and has developed guidelines for issuing the allotted monies. The committee's composition, which includes representatives from business and higher education, teachers, and the executive director, is extremely beneficial when a choice must be made between the requests of two teachers.

## The Finance Committee

While fund raising falls under the jurisdiction of the Finance Committee, it was a task and responsibility that consumed the entire board. Under the leadership of the chair of the Finance Committee, and with advice from an experienced fund raiser in the area, the board undertook a fund-raising campaign in which individual board members contacted potential contributors. This strategy had mixed success in that volunteers from the board contacted only a few of the names from the list of previous donors and most board members had difficulty completing the solicitations within the necessary time period. Furthermore, not all board members were comfortable raising funds; many did not mind contacting people they knew, but were not as ready to approach strangers. When it became apparent that this personal approach would be inadequate, the board engaged in a broader campaign that included the IBM breakfast on April 6, an effort to increase community recognition by having the mayor declare a DMC day, and a slide presentation to inform the public about the collaborative's activities and its need for financial support.

### The Steering Committee

The Steering Committee, composed entirely of teachers, has increasingly assumed responsibility for identifying collaborative activities. This committee decided that it would sponsor a Math Fair next year and held a retreat in May to generate other ideas for the future.

Teachers have input into all levels of governance. The two teachers who have been members of the Board of Directors since its inception also sit on the Advisory Committee. All teachers are kept informed of collaborative activities through the newsletter and are continually asked for suggestions for activities by contacting the Steering Committee representative from their school. Thus the Durham Mathematics Council has created a viable structure for governing a collaborative, one that brings together people from all sectors to make policy decisions and assigns teachers a central role in planning activities.

## Collaboration

The Durham Mathematics Council has helped to remove barriers between city and county teachers by providing opportunities for them to become acquainted and to work together. The teachers are facing a proposed school merger, an issue over which the two groups have expressed divergent viewpoints. The DMC provides a working example of cooperation and understanding among teachers. Asked about the effect of the collaborative on relationships among mathematics teachers, a teacher responded, "I feel less smug about the mathematics teachers in other schools now that I know and respect them from working with them on DMC activities." The range of activities--including receptions, workshops, networks, the Triangle Math Club, and access to regional and national conferences--draws teachers into cooperative, collegial relationships. During

1988-89, sharing among teachers was enhanced through follow-up sessions to workshops at which teachers shared the lesson plans they had developed as a result of the workshop. The follow-up sessions were motivated by a need to extend the workshop experience to ten hours in order to qualify for continuing education units (CEUs), but resulted in teachers benefiting from what other teachers had done. These sessions, along with the subject area networks, have increased teachers' sense of professional collegiality. "Prior to DMC, I knew very few [teachers in other schools]," commented one teacher. "Now I know them and see and work with them often. We are much closer, exchange information and ideas."

During 1988-89, the DMC made an effort to extend its networking to reach teachers at the regional and state levels. DMC teachers made presentations to their colleagues from around the state at the Statistics and Data Analysis workshop sponsored by NCSSM. A DMC teacher teamed with a regional mathematics coordinator to present the Mathematics Manipulatives Kit workshop to DMC teachers. This coordinator also contributes regularly to the collaborative newsletter. The state mathematics supervisor met with the Geometry Network to discuss the end-of-year geometry test, and DMC teachers' involvement in the Family Math program influenced the University of North Carolina-Chapel Hill to offer a workshop to train leaders on this topic. As a result of these networking efforts, the DMC has come to be recognized as a model program within North Carolina, a significant achievement in that education in North Carolina is state controlled and NCSSM is financed by state funds. This year DMC has made significant progress toward reaching its goal of being more visible within the state.

As in previous years, DMC activities this year continued to provide teachers with opportunities to interact with professionals from business and higher education. Both professors and business people conducted workshops, made presentations at collaborative events, and remained very active in collaborative governance. This year, several business representatives on the board expressed interest in developing partnerships with teachers. As a result, teachers report that the collaborative has provided them with opportunities to network with representatives of business and industry and, to a lesser degree, of higher education. "In business and industry, I already knew some folks and now know a few more. I have met more mathematicians in higher education and am more aware of them, I do not feel that they are as out of touch with the real world as I once did," commented one teacher. Another teacher observed, "I know a lot more people from business and industry than I did before . . . . I have had little contact with people from higher education other than speakers and resource people for DMC activities." These remarks are consistent with teachers' responses in reports from previous years.

Both the city and the county school districts have expressed their support of the collaborative by providing up to 75 days of substitutes for DMC teachers during the school year, as well as cash contributions to be allocated at the collaborative's discretion. This support has been essential to the collaborative, as it has made it possible to hold workshops during school hours and to send teachers to conferences. As with the changes taking place at NCSSM, the strength of the collaboration concept in Durham will be evidenced by continued strong district support as both districts progress under the leadership of new superintendents.

### Professionalism

The Durham Mathematics Council has increased the professional involvement of mathematics teachers through the grant opportunities and enrichment activities it has provided them. As a result of their DMC membership, more teachers have joined professional organizations, attended professional conferences, and engaged in a greater variety of professional activities. "Because of DMC I have rejoined NCTM and NCCTM after several years of not belonging to either organization," noted a frequent participant in DMC activities. Another teacher reported, "I had never belonged to either NCTM or NCCTM until I became associated with DMC. I had never gone to a conference until then. I now belong to both organizations and attend at least two conferences a year." A teacher who has always been a member in professional organizations observed, ". . . I had never attended a conference until urged to do so and given assistance by the DMC. This attendance has been invaluable to me as a teacher and as a person." A DMC teacher who had attended a technology conference with DMC support published an article in the Fall edition of the Consortium. The article discussed a new software, Hierarchial Music Specification Language, which allows the user to compose music and to analyze compositions.

Mathematics teachers are assuming greater leadership roles than they had in the past. In 1988-89, DMC teachers led workshops for their colleagues, a distinct divergence from earlier years when the collaborative had drawn upon outside resources to develop and present workshops. Teachers have also become more active in decision making within their schools. One teacher commented, "I now make sure that I am aware of what is going on and that I have input into decisions. DMC has given us the clout to exercise our options in the selection of textbooks and curriculum decisions." Because teachers are more confident, more willing to make decisions and exert themselves, changes are taking place in the curriculum. Some teachers confronted an administrator who wanted to introduce a third year of general mathematics and convinced him that a course involving higher level mathematics would be preferable. One of these teachers declared, "I know what is new and what is needed. I am able to tell my principal what should be done. This past year at a curriculum meeting we did so and our opinion was respected and adopted." The recipient of the Presidential Award from Durham made a presentation at the Helena, Montana NCTM regional meeting in February. Some of its success with teachers in leadership positions may be attributed to the DMC strategy of requiring that teachers who receive grants give presentations, develop workshops, or write articles so that other teachers can benefit from the experience.

Perhaps as a result of their professional activism and increased leadership, collaborative teachers are feeling more empowered. One teacher commented, "The collaborative has made me feel more professional. I realize that I have the power to change things as well as the ability to do so." Another teacher asserted, "I am more confident. Avenues have been opened to me that have given me leverage that I can use to affect the decisions made in my school and in my system." A third teacher reported, "We have the attitude that if we need something we will find a way to get it one way or another." The change in teachers' attitudes about their own influence and power seems to be attributable to the collaborative in several ways. First, teachers feel they are current on issues in mathematics education. Presentations by teachers influential at the national level, such as Gail Burrill, and workshops on the latest technology help to keep teachers informed, and they have come to recognize the importance of staying up-to-date. "I feel that the collaborative keeps us on the cutting edge of what is happening in the field and gives us the help and material we need to implement some of the new ideas," explains one teacher. Second, the collaborative provides teachers with a support group and a sense of professional identification. Asked how the collaborative has helped them, teachers report that, among other things, it gives them clout with the administration and makes them comfortable knowing they can call on their colleagues from across the two districts if necessary. Third, the collaborative has made teachers an integral part of a broader professional network that includes all sectors, including representatives of business and higher education. Finally, the collaborative has worked to ensure that teachers receive the professional recognition they deserve. A teacher who is very active in DMC was awarded the Presidential Award for Excellence in Mathematics Teaching. Another active DMC teacher was one of only 50 educators chosen to attend the Woodrow Wilson Summer Institute on Algebra in Princeton out of more than 1,000 applicants. It is clear that the Durham Mathematics Council is having a positive effect in terms of how teachers view themselves as professionals and how they are assuming more professional responsibilities.

### Mathematics Focus

Because curriculum reform continues to be an overriding theme of the DMC, the collaborative has provided teachers with a variety of enrichment experiences focused on the use of technology, statistics and data analysis, and manipulatives. Teachers' interest in the use of calculators in the classroom is evidenced by the number of mini-grant requests for classroom sets. The IBM workshop demonstrated the use of computers in teaching mathematics and provided teachers with information on the use of the IBM Mathematics Exploration Toolkit. The subject area networks expanded from three (Algebra II/Pre-Calculus, Geometry, and Middle School mathematics) to five when networks for calculus and basic mathematics were added. There are now networks for all major curricular areas with the exception of algebra. The networks seem to be fulfilling a need, although attendance has been affected by other activities. This year, as added incentive for attending a network session, the hours count toward CEUs that can be used for recertification.

As a result of the collaborative, teachers seem to be more aware of current trends. When asked if this is true, one teacher noted, "Absolutely!! ... The workshops, seminars, conferences and networks sponsored by DMC have made us aware of all trends and have enabled us to adopt some of them. We have been aware of every step along the way of the new Standards." Teachers are also making changes in how they teach mathematics and are more flexible regarding new ideas. Asked about ways the collaborative has changed their view of the mathematics curriculum, one teacher noted, "We are putting a great deal more emphasis on the practical applications of the things we teach. Our approach to geometry has changed a great deal. We are open to new ideas and try to incorporate them into our curriculum." Another teacher, who had visited the UCSMP in Chicago, reported, "We realize the importance of stressing problem solving and plan to incorporate it into all of our courses." Teachers are sensing changes in their students and some are attributing the changes to their own renewed interest in teaching as a result of their collaborative participation. One teacher hypothesizes, "The students are more enthusiastic and appear to enjoy the mathematics more than in the past. This is due to many things. Perhaps I am a more caring teacher now, perhaps I am able to make the material more interesting." Another teacher is hesitant to draw conclusions, "I am not sure that any change I may see can be attributed to my collaborative participation, but it does seem to me that my students are more motivated and less fearful of mathematics."

The collaborative has helped teachers to fit together the pieces of a complex puzzle that includes recommendations for reform, the mathematics being used in the workplace and the need to find innovative challenging ways to involve students in learning mathematics. According to one teacher, "Personally, I really appreciate mathematics much more. I see adults using the mathematics that I teach. I have been inspired to know more. I see what I do as important far more than I did before."

## F. Next Steps

The process of hiring a new executive director will begin during the summer, 1989. The position will be announced in the DMC Newsletter and other publications. The Woodrow Wilson Foundation Geometry One-Week Summer Institute will be held on July 24-28, 1989, at the NCSSM. Ten DMC teachers will attend. The Board of Directors is scheduled to meet July 19, 1989. In August, two teachers who were selected by the executive director from the list generated by the Steering Committee will attend the UMC Teacher Leadership Workshop to be held in Newton, Massachusetts.

The planning initiated at the May retreat will be continued and some activities identified at that time will be developed. These include a Math Fair that is tentatively scheduled for January, 1990. In addition to these activities, the regular activities of the networks will continue and Steering Committee meetings will be held. DMC will continue to increase the involvement of teachers in making decisions regarding collaborative activities and in taking leadership roles in the collaborative.

# SUMMARY REPORT:
# LOS ANGELES URBAN MATHEMATICS/SCIENCE/TECHNOLOGY COLLABORATIVE

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Los Angeles Urban Mathematics/Science/Technology Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Los Angeles Urban Mathematics/Science/Technology Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1988; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

# LOS ANGELES URBAN MATHEMATICS/SCIENCE/TECHNOLOGY COLLABORATIVE

## A. Purpose

The Los Angeles Urban Mathematics/Science/Technology Collaborative is the official title of the 57-member Advisory Committee to the Los Angeles Educational Partnership (LAEP). This committee, established in 1986, was the product of the consolidation of the advisory committees of the Los Angeles Urban Mathematics Collaborative and the Mathematics/Science Fellowship Advisory Board. The Advisory Committee did not meet in 1988-89, pending its redefinition by LAEP. A special four-person task force that included the LAEP Executive Director, the +PLUS+ director and the chairperson of the Advisory Committee was charged with determining the role and composition of an advisory group to the five programs: +PLUS+ (Professional Links with Urban Schools), Model Technology Project, Target Science, and Industry Initiatives in Science and Mathematics Education (IISME), and TELE-Venture. It is expected that this Advisory Committee would be an advocate of the five programs in interactions with the LAUSD School Board and the LAEP Board. It is possible that the committee would also hire a half-time coordinator to provide administrative support.

+PLUS+ (Professional Links with Urban Schools) constitutes the Los Angeles Urban Mathematics Collaborative. It is the goal of the +PLUS+ project to broaden teachers' mathematical horizons by encouraging them to interact with their colleagues in a mathematics resource network, and to help them relate the mathematics curriculum to the world of work. It is expected that teachers will benefit from expanded horizons and increased interaction with their colleagues. +PLUS+ activities during the 1988-89 school year included an expansion and continuation of those cited in the original funding proposal: networking and collaboration among teachers and among mathematics departments; the expansion of mathematics resources to encompass more state and national resources; the development of team building and leadership skills among mathematics teachers; additional opportunities for teachers to develop, evaluate, and integrate new materials and methods into the curriculum.

+PLUS+ activities are directed toward achieving four objectives:

1. To broaden the scope of teachers' knowledge about mathematics and its applications in industry and research;

2. To provide opportunities to develop, evaluate and integrate new materials and methods into the curriculum;

3. To provide team-building and leadership training to enhance the professional status and effectiveness of teachers; and

4. To create a collaborative network of teachers, math departments and resources within Los Angeles, the state of California and the nation.

## B. Context

Los Angeles County, the largest urban center in California, has experienced a steady and steep increase in population over the last decade. Since 1980, the population has grown by 11 percent to a current level of 8.3 million. The majority of new residents are from ethnic/minority backgrounds, with Hispanics and Asians accounting for most of the total population growth. The majority of this growth stems from births in the county; however, a rising number of immigrants to the city (one sixth of the total number of immigrants to the United States) choose to reside permanently in the Los Angeles area. More than 20 percent of all children in Los Angeles County live below the poverty level.

The county incorporates 82 public school districts consisting of 228 elementary, 39 high schools and 1,267 unified schools (869 elementary, 188 junior high, 133 high schools and 141 continuation schools). Enrollment in these districts ranges from 69 students in the smallest district to approximately 600,000 students in the largest school district--the Los Angeles Unified School District. Enrollment has increased from 1.2 million students in 1980 to 1.32 million students in 1987-88, a gain of 10 percent, while the number of schools serving these students has decreased by 5 percent in the same time period. Forty-seven percent of students enrolled are Hispanic, 29 percent are white, 14 percent are black, 9 percent Asian/Pacific Islanders, and 2 percent are from other ethnic groups. Of the 570,000 students whose primary language is not English, approximately 290,000 exhibit limited-English proficiency (LEP).

Of the 55,375 certified school staff in Los Angeles County in 1988-89, 71 percent are white, 13 percent are black, 9 percent are Hispanic, 6 percent are Asian/Pacific Islander and nearly 1 percent are Native American Indians. Thirty-one percent are male and 69 percent are female. Ninety-five percent are employed full-time. The average salary in 1987-88 was $34,415. Forty-five percent of certified staff have obtained at least a master's degree and 96 percent have at least a bachelor's degree. The median age of the staff is 44 years, of which an average of 16 years have been spent working in education.

Of the 53 mathematics teachers from the 13 +PLUS+ schools in the county who filled out questionnaires for the UMC Documentation Project, 57 percent are white, 19 percent are Hispanic, 13 percent are black, 8 percent are Asian and 4 percent are from other ethnic groups. The mean age for these teachers is 38 years, with an average of 12 years in the teaching profession, of which 11 years were spent teaching mathematics. Seventy-nine percent of the +PLUS+ teachers who responded to the questionnaires have standard credentials, while 21 percent hold temporary or emergency credentials. According to the director of +PLUS+, this subgroup of teachers is roughly representative of all +PLUS+ teachers.

Major problems facing school districts in Los Angeles County include overcrowding, integration issues, and language barriers. Even if the problems of poverty, violence and drug abuse were eliminated, it would still be most difficult for school and county officials to meet the educational needs of all students. The formation of collaboratives such as the +PLUS+ project, therefore, is particularly crucial in that it provides teachers with an arena for the development and communication of strategies for overcoming these obstacles and for creating novel and exciting instructional procedures in order to more effectively educate students. During the 1988-89 school year, the +PLUS+ departments were from three school districts: Los Angeles Unified School District, (LAUSD), Inglewood Unified School District (IUSD), and El Monte Union High School District (EMUHSD). LAUSD is by far the largest of the three.

**Los Angeles Unified School District (LAUSD)**

The Los Angeles Unified School District (LAUSD) has an enrollment of 600,000 students, representing an 11 percent increase in enrollment since 1980 and a 2 percent increase since the 1985-86 school year. Fifty-seven percent of the total student population is Hispanic, 18 percent is black, 17 percent is white, 6 percent is Asian and 1 percent is from other ethnic groups. The district serves 425,000 elementary students (grades K-8) at 483 schools and 164,000 high school students (grades 9-12) at 49 schools. Included in these totals are 27,094 magnet school students who attend 85 schools; 5,022 opportunity and continuation students at 55 schools; and 4,115 students at 18 schools for the disabled. The district also operates 90 children's centers, 16 latchkey after-school programs, ten after-school enrichment programs and four infant centers.

The 49 high schools in the LAUSD enroll 164,000 students. Forty-nine percent of the students are Hispanic, 22 percent are white, 19 percent are black, 8 percent are Asian and 2 percent are of other ethnic ancestry. Fourteen percent of the students in the LAUSD consider English a second language. Seventeen percent receive AFDC support, and 23 percent are eligible for government-subsidized lunches. Twenty-seven percent are LEP students and of these, 89 percent are native Spanish speakers. The annual dropout rate in the LAUSD for grades 10, 11, and 12 was 14 percent for the 1987-88 school year--4 percent lower than the 1986-87 school year. In the 1987-88 school year, seniors from the 13 LAUSD +PLUS+ schools scored an average nearing the 5th percentile for both reading and mathematics on the California Assessment Program Test, with district averages ranging in the 15th percentile in reading and the 16th percentile in mathematics based on state norms. However, approximately 47 percent of students in grades 9-12 scored above the national norm in the Comprehensive Test of Basic Skills-Form U. The requirements for graduation in the LAUSD include two years of mathematics.

Of the 25,071 certified LAUSD staff in 1987-88, 62 percent are white, 18 percent are black, 10 percent are Hispanic and 7 percent are Asian, with 2 percent from other ethnic groups. The average age of staff members is 44 years, of which 15 years have been spent working in education. Ninety-three percent of the certified staff have earned at least a bachelor's degree and 38 percent hold at least a master's degree. The average salary for the 1987-88 school year was approximately $35,028.

In 1986-87, there were 5,500 teachers in the LAUSD high schools. Of these, 67 percent were white, 15 percent were black, 10 percent were Hispanic, 7 percent were

Asian and 1 percent were of other ethnic origins. Approximately 800 high school instructors teach mathematics in the LAUSD. Sixty-eight percent of these are male and 32 percent are female. Sixty-five percent are white, 12 percent are black, 12 percent are Asian, 8 percent are Hispanic and 3 percent come from other minorities. Of the 98 percent who have earned at least a bachelor's degree and the 38 percent who have at least a master's degree, 85 percent are certified to teach mathematics and 15 percent hold emergency certification. Eighty percent of mathematics teachers in the LAUSD are tenured.

The Superintendent and Chief Executive Officer for the LAUSD is Dr. Leonard Britton, who took office in the summer of 1987. Dr. Britton has introduced the idea of "participatory management," in which teachers have input as professionals and interact with their principal and community representatives in decision making at their own schools. Dr. Britton believes it is important to involve teachers as professionals, to give them some ownership of the decisions that are made, in order to determine the most effective way of providing a superior education for students.

Expenditures by the LAUSD in 1987-88 totalled approximately $3.2 billion. Seventy-seven percent of the budget came from state funding, 11 percent came from local funding and 9 percent came from federal sources, while 3 percent originated from outside sources. The annual budget increased to $3.8 billion for the 1988-89 school year.

An estimated 69 percent of the 5,500 high school teachers in the LAUSD are members of an active teachers' union: the United Teachers--Los Angeles (UTLA), an affiliate of NEA and AFT. Contracts were reopened for negotiation in October, 1987 and were due for renewal in June, 1988. In May, 1989, 77 percent of the 22,000 members of the UTLA voted in favor of a districtwide strike, the first strike in Los Angeles County in 19 years. The union demanded a 21 percent pay increase over two years; the district offered 21.5 percent over three years.

It was estimated that 21,000 to 25,000 teachers stayed away from work during the strike. Due to the shortage of teachers, attendance levels plummeted to about half of all registered students. The district was forced to hire 500 new substitute teachers at the inflated pay of $180 per day, and an additional 500 administrators with credentials taught classes. Despite these expenses, the district saved approximately $12 million in salaries in the first week of the strike alone. Some schools resorted to showing popular movies to keep students in school.

It is estimated that a $2.5 billion state tax windfall will bring the district an additional $120 to $228 million over the next two years. In response to news of the windfall, the UTLA altered its position from an increase of 21 percent over two years to 26 percent over three years. The strike ended after nine days of negotiation. The settlement granted teachers a 24 percent pay boost by 1990 and a greater voice in matters of school policy. By the end of the three-year contract, starting salaries for teachers will be $29,529, with top pay at $53,938. The strike settlement represented resolution of the wage dispute, one of several issues being negotiated; bargaining on other issues continued.

**Inglewood Unified School District (IUSD)**

Inglewood Unified School District (IUSD), the second largest school district in the Los Angeles collaborative, served approximately 16,000 students in 1987-88, an increase of about 2 percent from the 1985-86 school year and 12 percent since 1980. Of the total number of students in the district, 57 percent are black, 39 percent are Hispanic, 2 percent are white and 2 percent are from other ethnic groups. Twenty-one percent of the student population are LEP students; of these, approximately 97 percent speak Spanish as their native language. The dropout rate for grades 10-12 for the 1987-88 school year was 8.2 percent.

Of the 600 certified staff in the IUSD, 47 percent are black, 43 percent are white, 5 percent are Hispanic, 3 percent are Asian and 2 percent come from other ethnic origins. Twenty-six percent are male and 74 percent are female. The average age of the certified staff is 42 years, of which an average of 15 were spent working in education. Of the certified staff, 99 percent hold a bachelor's degree, and 53 percent have earned at least a master's degree. In 1987-88, the average annual salary for certified staff was approximately $35,076.

Morningside High School, the IUSD +PLUS+ school, is one of two high schools in the district. Of the 1,400 students enrolled in Morningside during the 1987-88 school year, 51 percent were male and 49 percent were female. Seventy percent were black, 29 percent were Hispanic, and 1 percent were from other ethnic groups. Approximately 18 percent of the student population speaks English as a second language. Thirty-eight percent of the students' families received AFDC support. Although the cumulative dropout rate averages 45 percent, approximately 60 percent of graduates go on to post-secondary education. In 1987-88, the average score for Morningside High School seniors on the

California Program Assessment Test ranged in the 9th percentile in reading and the 4th percentile in mathematics, based on state norms.

Seventy-three teachers, 42 male and 31 female, serve the student population at Morningside High School. Forty-one teachers are black, 30 are white, one is Hispanic, and one is Asian. Ten teachers teach mathematics. Of the nine males and one female, seven are white and three are black. All ten have a bachelor's degree and six have earned at least a master's degree. All are certified and tenured.

The annual budget of the IUSD totals approximately $49 million. Nearly 82 percent of total revenue comes from the state, 13 percent is generated locally, and almost 5 percent comes from federal reserves. Approximately $270,000 (0.6 percent) comes from outside sources.

The superintendent of the IUSD resigned in the spring of 1988, leaving the district with a $4.17 million deficit that represents approximately 9 percent of the total budget. Approximately $2 million of this deficit was forwarded to the 1988-89 school year budget. The new superintendent, George McKenna, was offered a five-year contract with an annual salary of $85,000.

**El Monte Union High School District (EMUHSD)**

The El Monte Union High School District (EMUHSD) serves approximately 8,000 students, an increase of 2 percent since 1985-86 and 14 percent since 1980. Mountain View High School, the district's only +PLUS+ program, is one of four high schools in the district. Of the total student population, 70 percent is Hispanic, 17 percent is white, 10 percent is Asian, 1 percent is black and 2 percent is from other ethnic groups. Twenty-two percent are LEP students; of these, 80 percent are native Spanish speakers. The dropout rate for the EMUHSD for the 1987-88 school year was approximately 11 percent for grades 10, 11, and 12. In 1985-86, the average score on the California Assessment Program Test for Mountain View High School seniors approximated the 14th percentile in reading and the 23rd percentile in mathematics, based on state norms.

In 1987-88, the EMUHSD employed 343 certified staff, of which 56 percent were male and 44 percent were female. Of these, 74 percent were white, 19 percent were Hispanic, 4 percent were Asian, 2 percent were black, and 1 percent came from other minority groups. The staff's average age was 42 years, of which an average of 15 years were spent working in the field of education. Ninety-three percent of all certified staff have earned a bachelor's degree and 48 percent have earned at least a master's degree. The average salary is approximately $33,641 per year.

EMUHSD's 1986-87 school year budget totaled $28 million. Of this, approximately 80 percent originated from state funds, 14 percent from local revenue and 5 percent from federal sources, while about $400,000 (1.4 percent) came from outside sources.

### Additional Information

On December 15-16, 1988, representatives from business, industry, government, and education gathered to discuss shared concerns about quantitative and problem-solving skills of the workforce, linking mathematics education to the health and competitiveness of business and industry. This national symposium, "Mathematics Education: Wellspring of U.S. Industrial Strength," was an inaugural event for the Arnold and Mabel Beckman Center of the National Academy of Science and Engineering in Irvine, California. Both Collaborative Executive Director Peggy Funkhouser and Project Director Toby Bornstein attended the conference. Ms. Funkhouser reported on the Los Angeles Educational Partnership and addressed the issue of corporate involvement in mathematics education. Ms. Bornstein displayed materials from +PLUS+ activities that demonstrated the role that business can play in mathematics collaboratives.

## C. Development of the Collaborative

The Urban Math/Science/Technology Collaborative is operated by the Los Angeles Educational Partnership (LAEP) and its Board of Directors with an annual budget of more than $2 million. Ms. Peggy Funkhouser is the Executive Director of LAEP and, as such, is the director of the Urban Math/Science/Technology Collaborative. The Urban Math/Science/ Technology Committee is an advisory committee to the Board and was designated as the policy maker for its mathematics and science components: the Model Technology Project (K-12), Professional Links with Urban Schools (+PLUS+) project, and Target Science for K-12. Programs that are available to both +PLUS+ and Target Science participants include Industry Initiatives in Science and Mathematics Education (IISME) and TELE-Venture.

The Urban Math/Science/Technology Committee, a group of nearly 60 members, did not meet during the 1988-89 school year. A small task force which included Ms. Funkhouser, Ms. Bornstein, Committee Chair Tomash, and one other member met in the spring to discuss reconstituting the committee. One aim in changing the composition of the committee would be to increase its effectiveness as a mathematics and science advocate with the LAUSD board and the LAEP board. At the end of the school year, a decision had not yet been reached on reforming the committee.

The +PLUS+ Project Director, Toby Bornstein, is assisted by a full-time administrative assistant, Ms. Debbie Novick. On March 8, 1989, Ms. Kathy Blackwood, a teacher from Venice High School, received release time from LAUSD to serve as the full-time +PLUS+ coordinator through January, 1990. In February, 1990, she will begin to teach one-half time and spend the other half of her appointment as coordinator of a +PLUS+ Satellite Teacher Council. The on-site observer is Mr. Richard Curci, a high school mathematics and mentor teacher.

The +PLUS+ project's membership is comprised of teachers from the mathematics departments that receive a +PLUS+ grant, teachers who attend the +PLUS+ workshop series, and representatives from business and higher education who serve as associates. From 1985 through 1989, more than 300 teachers have participated in the departmental planning grant program. Ninety-seven teachers from 52 schools in ten districts within Los Angeles county participated in the 1989 +PLUS+ Workshop Series. Thirty teachers in 1988-89 participated in the Teacher Associate Pairs, and approximately 30 teachers participated on the Teachers' Council. While many teachers have participated in more than one of the +PLUS+ activities, +PLUS+ has involved more than 400 different teachers at some time.

The +PLUS+ project's expansion strategy includes developing satellite Teachers' Councils of six to eight +PLUS+ departments over an extended period of time. Each Teachers' Council would be facilitated by a teacher coordinator, who would be released from teaching for one year to work as the +PLUS+ coordinator, thereby receiving the training necessary to oversee a Teachers' Council. Ms. Blackwood is the first teacher to fulfill this position. Although the 1988-89 LAUSD/+PLUS+ budget provided for a full-time teacher coordinator, arranging for Ms. Blackwood's release required a special effort. Funding for all new positions was frozen at the beginning of the school year, pending the settlement of the contract with the Union of Teachers of Los Angeles. In order to transfer Ms. Blackwood, even temporarily, approval had to be obtained from her principal and a long-term substitute had to be hired for her teaching position. Although these arrangements had been finalized, district authorization was not received in time to release Ms. Blackwood in September, 1988, or in February 6, 1989, which were the times that had been designated for her to assume the coordinator position. After these unsuccessful attempts to receive approval to release Ms. Blackwood, on March 6 LAEP Executive Director Peggy Funkhouser wrote a letter to the LAUSD Deputy Superintendent expressing the need for a decision. In her letter, Ms. Funkhouser explained that if Ms. Blackwood could not be released, the planned expansion to additional schools would not go forward. Ms. Blackwood was released on March 8, 1989.

In June, 1989, a position announcement for a new +PLUS+ coordinator was distributed to +PLUS+ teachers. The new coordinator will work at LAEP during the 1990-91 school year in preparation for becoming a coordinator of a satellite Teachers' Council. As part of the training, the individual also will be employed by LAEP as an IISME fellow during summer 1989 and 1990, (or during off-track periods if the teacher coordinator is at a year-round school). With the fellowship, the coordinator will receive $4,500 for each eight-week period. In fall 1991, the coordinator will return to school teaching half-time and serving half-time as the coordinator of a satellite Teachers' Council.

Announcements for two additional positions available during the summer of 1989 were circulated to +PLUS+ teachers early in June, 1989. The first position involved producing a video of +PLUS+ activities that could be used in recruiting new departments and in documenting the accomplishments of +PLUS+. The position, which pays $2,500, required access to a camera, tape deck and editing equipment. The second summer position was to organize existing mathematics resource materials into a database that will access information for teachers regarding mathematics materials, software and videos. This position pays $4,500 and its responsibilities could be covered working at home, providing the person has the appropriate software and computer.

In addition to a system of teacher coordinators, the long-term strategy for expanding +PLUS+ includes identifying resource teachers or mathematics consultants who will serve as instructional leaders while they maintain close ties to the LAUSD Office of Instruction. Ms. Margaret Shoukry, department chair at Morningside High School, was assigned the responsibility of developing a plan for the mathematics consultant component of +PLUS+. She solicited suggestions from other teachers through TELE-Venture. It was proposed that the mathematics consultants teach half-time at their own schools, and spend the remaining time assisting other teachers; 25 percent of their consulting time would be spent at their own schools with the remainder devoted to other schools.

The LAUSD/+PLUS+ budget had allocated funds for replacement time for four half-time mathematics consultants, but the same district funding freeze that prevented the release of the coordinator also impeded development of the teacher consultant program. One issue that contributed to the apparent lack of support for the consultant program was the state's perception that the district's 11-1 ratio of teachers to administrators was weighted too heavily with administrators, and that reassigning full-time teachers into half-time mathematics consulting positions would only exacerbate the problem.

## +PLUS+ Department Grants

At the beginning of the 1988-89 school year, there were 15 +PLUS+ senior high schools: Manual Arts, Wilson, Franklin, Jordan, Venice, Washington, Bell, Belmont, Crenshaw, Dorsey, Fremont, Huntington Park, and University from LAUSD; Mountain View from El Monte Unified School District; and Morningside from Inglewood School District. In total, 209 mathematics teachers from these 15 schools were involved. As a means of categorizing the +PLUS+ departments according to their stage of development, they are labeled in classes by the year they joined the program; for example, the three departments in the class of 1985-86 are from Manual Arts, Wilson, and Mountain View, although Manual Arts withdrew from the program at the end of the 1986-87 school year and rejoined in 1988-89. The class of 1987 is composed of departments from Franklin, Jordan, Venice, Washington Preparatory, and Morningside. In November, 1988, however, the mathematics department at Franklin withdrew from the program. Departments from seven schools formed the class of 1988: Bell, Belmont, Crenshaw, Dorsey, Fremont, Huntington Park, and University.

Each class of schools is eligible for specific benefits in the +PLUS+ project. The seven new departments that form the class of 1989, for example, were eligible to apply for $2,500 +PLUS+ department grants to be awarded in September, 1989. In order for a department to receive this grant, the school district had to commit to providing five substitute days to be shared by teachers in the department and professional expert pay of up to $500 to implement the department's plan. The seven remaining schools in the classes of 1986 and 1987, having already completed their year of implementation, were eligible to apply for continuation grants. Teachers from these seven departments were also eligible to represent their department on the +PLUS+ Teachers' Council.

As part of the grant process, departments are required to evaluate the results of their departmental plans. A summary of these evaluations, listing the original goals and anticipated outcomes, impediments to success, and unexpected outcomes, was prepared for the February, 1989, Teachers' Council meeting. Outcomes included staff development, such as demonstrations of the use of computers in the teaching of mathematics; training on the Geometric Supposer software; increased communication among teachers; increased participation in professional organizations and attendance at conferences; acquisition of equipment, such as a PC viewer; creation of an office for the mathematics department; and a computer lab. Other outcomes related to students included: increased enrollment in Algebra I classes; the presentation of daily lessons that illustrate the value of knowing mathematics; and creation of a reward system for students. Impediments generally were related to the need for more time, or lack of motivated people to work on the project. Some of the unexpected outcomes were teachers' increased interest in new activities, professional contacts made outside of school, and collegial problem solving.

## Teachers' Council

The Teachers' Council is the major decision-making body for +PLUS+. It is designed to promote leadership and to sustain the +PLUS+ network. The Council by-laws, which were approved at the June, 1989, meeting, defined the Council's purpose: "to promote teacher leadership in mathematics education, sustain the +PLUS+ network, further the objectives of +PLUS+ and establish regional satellite councils with eventual dissolution of the original Teachers' Council upon full implementation of satellite Teachers' Councils."

One teacher from each of the three 1985-86 and the five 1987 departments was designated as a Teachers' Council member. Council members and one additional teacher from each +PLUS+ department are invited to attend the monthly meetings of the Council, generally scheduled on the first Monday of each month. In addition to the +PLUS+ teachers, Ms. Bornstein and Ms. Novick attend the meetings. Each Teacher Council member received a Council Handbook to store printed material describing the +PLUS+ project, with the expectation that the material would be available to all department members and brought to each of the Teachers' Council meetings. Minutes of the meetings are distributed to all Council members, as well as to district staff. In addition, the minutes are available on TELE-Venture, where they can be read by all +PLUS+ members and district staff.

The Teachers' Council held nine regularly scheduled meetings during the 1988-89 school year. Ms. Kathy Blackwood led the September meeting. However, because she was not released from her teaching duties to serve as the +PLUS+ teacher coordinator as had been anticipated, Project Director Toby Bornstein chaired the next several meetings. After Ms. Blackwood's appointment as teacher coordinator in March, she again led the meetings. The attendance at the meetings ranged from nine to 16, with an average attendance of 13. A retreat/conference was held April 29 in place of the May meeting; 23 teachers and department chairs participated, for a total of 31 participants.

The agenda for the Council meetings generally included a review of the minutes from the previous meeting, a discussion of the previous month's action items, a report by the project director, and a review of the program activities and issues. Most meetings were held at the LAEP office and included dinner. Although the meetings were to last only two hours, several of the meetings ran longer so that all agenda items could be covered.

In the spring of the 1988-89 school year, the Teachers' Council began to establish special subcommittees to work out the details of a project or activity. The subcommittee would report to the Council, which would then make final decisions. The three subcommittees established during the year were the Jaime Escalante Award Committee, the Retreat/Conference Committee, and the By-laws Committee.

Several issues that came before the Council in 1988-89 were discussed and acted upon by the Council as a whole. These issues included: the approval of Professional Development Grant requests; the development and growth of the +PLUS+ project; criteria for approving the +PLUS+ Department Grants; and the evaluation of the +PLUS+ project. In other actions, the Council selected the three teachers who would receive EDC funds to attend the UMC Leadership meeting in August, 1989, and allocated money to send a fourth. The Council also adopted a plan for hiring mathematics consultants, which was facilitated by the use of TELE-Venture; Council members entered plan drafts on the electronic network so that other members had the opportunity to respond to them. The Council also developed the format for some of the site visits and generated a list of concerns to be discussed at the first site meeting at Dorsey High School.

A significant amount of the Council's time in 1988-89 was devoted to planning and administering the Jaime Escalante Award program, and planning and coordinating the +PLUS+ Retreat/Conference on April 28-29, 1989. These events first appeared on the agenda of the September, 1988, meeting and were discussed at each subsequent meeting through April. In January, +PLUS+ engaged Ms. Pat Griffin, the part-time LAEP office manager, as a consultant to help the Teachers' Council's subcommittees follow plans through to completion. Ms. Griffin provided administrative support to the Council, which retained its leadership responsibilities. For example, in planning the Jaime Escalante Awards, the Council determined the selection and review process for the entries, the strategy for promoting the program, the criteria for selecting the award recipients, and the publicity for the award ceremony. Groups of teachers, some from the Council and others from the +PLUS+ departments, reviewed the 400 nominations, screened those to be considered further, and organized a selection committee of teachers, principals, parents, and others to select the finalists.

At the January 9, 1989 Council meeting, a committee was appointed to work with Ms. Griffin to establish a timeline for the retreat/conference to be held in April, 1989. Members of the Retreat Committee planned the agenda, identified speakers, secured the location, assisted in the preparation of materials, and supervised the meeting. On the first day of the two-day retreat, an extended Teachers' Council meeting was held to help orient the 1988 department members to the Council. At this meeting, the +PLUS+ project was reviewed and issues of permanence, leadership, and evaluation were discussed.

The role and responsibilities of the Teachers' Council continued to evolve during the year. In the previous year, the Council's major discussions focused on the structure of the +PLUS+ project and on strategies for involving teachers and administrators. During 1988-89, the Council became more involved in monitoring the details that make a program successful. Because of the numerous items being discussed, however, +PLUS+ meetings often went on at length, frustrating some of its members. Some Council members also expressed concern that the program was expanding too fast. As a part of the cover memo to the minutes of the January meeting, Ms. Bornstein commented on the "growing pains" of the Council, acknowledging the expanded role of the Council as its authority and decision-making responsibilities increased. She noted that a goal of +PLUS+ had always been teacher-directed improvements in mathematics education and explained that the perpetuity of +PLUS+ depends on teachers assuming a leadership role, making decisions and carrying them out. She stressed that the Council must have a mechanism to replenish leadership and to broaden the program's impact. The issue of teacher leadership and the role of the Teachers' Council was discussed at the February meeting. Those in attendance expressed their willingness to evolve into a group that would become an increasingly effective advocate for mathematics reform. Evidence of this was demonstrated at the June meeting, when the Council approved by-laws to establish a more formal structure for its operations. Council members have also assumed responsibility for a tentative schedule for the meetings next fall, with teachers assigned to work on specific topics. .

### New +PLUS+ Departments

In September, 1988, LAEP received a challenge grant from the Ford Foundation to address the issue of collaborative growth. One expectation was that the number of participating schools would be increased by 15 each year over a three-year period. The grant was supported by funds from the LAUSD to continue the program through June, 1991.

The process of identifying the mathematics departments to join +PLUS+ as the class of 1989 began formally on January 5, 1989, at an information meeting held from 4 to 6 p.m. at Wilson High School. To prepare for this meeting, +PLUS+ teachers met early on to plan their presentations. Senior high school principals and mathematics department chairpersons from schools in the LAUSD, Inglewood, Pasadena Unified, and El Monte Union districts received notices of the January 5 meeting, along with information about the +PLUS+ project. Sixteen people, including one representative from each of four interested departments, seven current +PLUS+ teachers, two representatives from the +PLUS+ office, and two representatives from the LAUSD offices, attended the meeting. Because attendance from interested schools was lower than anticipated, a second informational meeting was held January 19, 1989, at Birmingham High School, a school in the San Fernando Valley. Representatives from five other interested high schools attended. In addition to these two "recruitment" meetings, on-site department orientations were held at four high schools during the first part of February. The due date for applications to participate in +PLUS+ was extended from January 27 to February 10 to accommodate these on-site orientations.

At the orientation meetings, participants received informational handouts and application forms. The packets described the department planning activities required of +PLUS+ departments and provided details about the selection process, including the criteria for selection. A list of the benefits of being a +PLUS+ department also was distributed; these included: an improved mathematics program; teacher stipends of $50 for each planning workshop; department grants up to $2,500; district-sponsored substitute days for implementation; district-sponsored professional expert pay for implementation; contact with practicing mathematicians from business and universities; and local and national networking. Requirements for becoming a +PLUS+ department included: a minimum of 60 percent department participation, including the chairperson; the department chair or designated member agreeing to serve as the +PLUS+ team lead; principal and counseling staff cooperation; a team plan endorsed by the entire department; and district support of implementation through provision of substitute days, professional expert pay, and release time for special opportunities. The application included questionnaires for the whole department, for each member of the department, and for the principal.

Nine mathematics departments of LAUSD senior high schools submitted applications and on February 23, 1989, all nine were accepted as +PLUS+ departments. They included Cleveland, Francis Polytechnic, Hollywood, Locke, Monroe, North Hollywood, Pacific Palisades, Roosevelt, and Verdugo Hills. Two of the nine departments did not complete the proposal-writing process. The department from Pacific Palisades attended only the first planning session and the department from Locke completed the training, but never submitted a proposal. Following selection, seven new +PLUS+ departments began a grant-writing process to identify problem areas, develop an action plan, and write a grant for funds to implement the plan.

The development phase for preparing action plans and grants consisted of four parts: a team leads' training session, planning sessions, site visits by +PLUS+ staff, and a proposal review. A team of three teachers (Kathy Blackwood, Richard Curci, and Margaret Shoukry) from the Teachers' Council was selected to lead the new schools through this process. On March 9, these three teachers met with two representatives from each new department to discuss the grant-writing process and to outline strategies for conducting a needs assessment. The two representatives from each department were to include the department chair and the +PLUS+ team leads; if these two positions were filled by the same person, another mathematics teacher was invited.

The first planning session was held Saturday, March 25, from 8:30 a.m. to 12:30 p.m., followed by lunch. Representatives from each of the new +PLUS+ departments attended, as well as a representative from Manual Arts. Although Manual Arts had been one of the first +PLUS+ departments, most of its teachers had been inactive for the last two years.

The three teacher leaders from the Teachers' Council ran the session, with assistance from Dick Cone, a consultant. In addition, teachers from current +PLUS+ departments served as small-group facilitators. These teacher facilitators, however, were briefed on their responsibilities only 30 minutes before the meeting, which was insufficient training. All of the teachers in attendance received a $50 stipend, paid by the district. The facilitators also received $50, but their stipends were funded by +PLUS+.

The +PLUS+ staff visited the 1989 +PLUS+ departments during the weeks of April 3-7 and 17-21 to discuss their action plans and to answer questions. The second planning session was held Saturday, April 22, from 8:30 a.m. to 12:30 p.m. at TRW. A total of 50 people attended the session, including teams from eight departments. To help the departments refine their department action plans, on May 8 a packet was distributed to team leads containing sample proposals that had been submitted to LAEP for small grants, to +PLUS+ for departmental grants, and to the California State University Foundation. On May 19, the 1989 +PLUS+ departments submitted their preliminary proposals for review.

A committee of six +PLUS+ teachers, an LAUSD mathematics resource teacher, a supervisor, and a representative from industry reviewed the proposals. On May 30 all but the supervisor and industry representative met to make recommendations and help departments improve their proposals. The evaluations were returned on June 6 and the departments had a week to make changes before presenting their final proposals June 15. Teachers from all +PLUS+ departments were invited to hear a 10-minute overview of each plan. Twenty teachers, four district staff, and the +PLUS+ staff attended. Grant recipients were to be announced August 1, 1989, and the funds will be issued in September, to enable the departments to implement their plans during the 1989-90 school year.

### 1989 Department Action Plans

The department action plans developed by the new +PLUS+ departments all addressed problems relating to student achievement. Approaches to the issue varied from standardizing the curriculum within the department, to increasing student use of calculators, to changing the learning environment, to providing extra incentives. One department proposed purchasing calculators and training students to use them in solving mathematics problems. Another department proposed to increase student motivation by creating a mathematics media center, holding open houses for parents, and inviting industrial representatives to lecture students on applications of mathematics. A third department proposed to improve student performance by standardizing the Algebra I curriculum and increasing instructional time. A fourth department proposed to better meet the needs of students and to foster motivation by developing an innovative course of study for the general (high school) mathematics course. A fifth department proposed to standardize the Algebra IAB course in order to raise student motivation and to assure consistent coverage by teachers. A sixth department proposed to increase student motivation and lower student failure rates by standardizing the Algebra I, Geometry, and Algebra II courses and initiating mathematics competitions. The seventh department proposed to develop a student incentive program, including student recognition and contests, with the end goal of increasing student motivation. One of the 1989 +PLUS+ departments did not submit an action plan. This department was invited to reapply and submit a proposal for next year; it should be noted that, while the teachers may go through the training again, they will not receive a second stipend.

## 1988 Department Grants

In September, 1988, LAEP presented grants of $2,500 each to the seven mathematics departments in the 1988 +PLUS+ schools. The team leads from these departments met from 4-6 p.m. on September 19, 1988, at the LAEP offices to receive the grant checks and to review the mechanics of administering the grants. Each of these departments also received an allocation from the district of five substitute days and $500 in professional expert pay to implement their action plans. +PLUS+ provided all of the +PLUS+ departments with modems, software and data lines to enable them to participate in the TELE-Venture electronic network. The grant awards were announced in the winter, 1988 edition of the Los Angeles Council of Teachers of Mathematics Association newsletter, as well as in the LAUSD senior high division news. In addition to the grants, the departments received other kinds of support from +PLUS+ during the school year; the +PLUS+ director, for example, made a site visit to each of the program's departments during the year.

All of the teachers from the 1988 +PLUS+ departments were invited to participate in a retreat to plan the implementation of their grants. Seventy teachers attended the retreat, which was held from 8 a.m. to 5 p.m. Saturday, October 1, 1988, at the Northrop Corporation. The meeting was conducted by two consultants, Dick Cone and Judy

Johnson. Teachers from the early +PLUS+ departments served as facilitators for the 1988 departments, but their roles were restricted to answering questions; problem solving was left to the new departments. In a follow-up letter to one of the facilitators, Dr. Cone noted that the facilitators served as "silent prompters." The agenda included time for the departments to plan together, to report to the total group and to have their ideas reviewed by others, to develop their implementation plan, and to discuss the evaluation of the plan. Teachers from the 1988 +PLUS+ departments expressed appreciation for the meeting. Among the benefits that they reported were collegial exchanges with their department colleagues and the opportunity to follow an idea through the necessary stages of development.

The 1988 +PLUS+ departments' action plans concentrated on affecting student achievement. Problem areas identified in the plans included: students' mathematics preparation, appropriate placement of students, department cohesiveness and group planning, uniform standards for tests and textbooks, and student motivation. Proposed plans of action included: the development of student assessment tools, the integration of new teaching strategies, improving access to student mathematics achievement records, the use of student motivation and achievement techniques, stronger departmental standards and teacher accountability, and the infusion of technology into the mathematics program.

The department grants were administered through a trust account at each high school's Student Body Fund. Because most of the monies were to be used for instructional purposes, the issue was raised of whether the Student Body Fund was the most appropriate account, as money in this account is typically used to fund student activities. By the end of the school year, this issue had not been resolved. It was proposed that a letter from financial services be sent to principals to verify this procedure. The letter was subsequently written by the project director.

The 1988 +PLUS+ departments were required to submit a final report on their activities by June 30, 1989. They were asked to respond to four questions: What were the goals and objectives of your current +PLUS+ proposal? For each goal, what steps were undertaken and what outcomes were achieved? If you had goals that weren't achieved, what prevented your department's success? What were some of the accomplishments of +PLUS+ at your school which were not in the original plan? The departments were encouraged to build upon their discussions at the April retreat.

The 1988 departments also were eligible to apply for continuation grants for the 1989-90 school year. A workshop to help the departments develop proposals was set for July 10, 1989.

**Continuation Grants**

All +PLUS+ departments in the classes of 1986 and 1987 had the option of applying for continuation grants for the 1988-89 school year. A pool of $12,000 of +PLUS+ and LAUSD instructional materials monies was set aside to fund these grants. Out of five grant applications, four were awarded for a total of $7,500. In order to qualify, a department must have successfully completed the goals it had established under the department grant it had received in 1987-88, and submitted an evaluation of the use of those funds. Unlike the original department planning grant, which required 60 percent department participation, any number of teachers could apply for a continuation grant. The availability of the grants was publicized through the team leads. To receive the continuation grant, the teacher(s) were required to submit a plan for the coming year to the Teachers' Council. Five grant requests were submitted to the Council in February, 1989, but all were returned to the departments for revision. On March 8, 1989, the Teachers' Council funded four of the five grant requests that had been resubmitted.

The Jordan High School mathematics department was awarded $1,800 to purchase a PC Viewer and to fund student rewards and teacher conferences. The Venice High School mathematics department was awarded $1,242 to purchase a variety of manipulatives and software, with accompanying training sessions for teachers. The Washington Preparatory High School mathematics department was awarded $1,975 to purchase a PC Viewer and a variety of manipulatives with accompanying training sessions for teachers. The Manual Arts High School mathematics department was awarded $2,325 for the purchase of a computer and to support student and teacher conference attendance, membership fees, trophies and awards.

The continuation grants are viewed as a stage of development in the growth of the +PLUS+ project. In deciding whether to issue a grant, the Council held to the strong criterion of measurable outcomes; this decision was related to the Council's conviction that if +PLUS+ is to rely on district funding for permanence, the work of +PLUS+ must correspond to outcomes important to the district. While initial +PLUS+ grants had as their primary objective increased collegiality within departments, the continuation grants funded activities more closely aligned with the expectations of the school administration. Discussion regarding this issue was raised by the +PLUS+ director in a TELE-Venture forum.

## D. Project Activities

During the 1988-89 school year, the Los Angeles Urban Mathematics/Science/ Technology Collaborative's +PLUS+ project sponsored activities for teachers from 60 secondary schools in ten school districts, with teachers from other school districts invited as space allowed. The project also provided a variety of opportunities for the professional growth of the 21 +PLUS+ departments. In addition, +PLUS+ supported activities designed by each individual +PLUS+ department as part of its action plan, as noted above.

### +PLUS+ Workshop Series

A significant amount of the +PLUS+ project's time and resources during the 1988-89 school year were devoted to the third +PLUS+ Workshop Series. As in the past, the series consisted of four monthly Saturday morning content workshops geared to update knowledge and demonstrate applications and simulations from the world of work, with emphasis on the strands of the California Mathematics Framework and the NCTM Standards. The workshops are designed to allow participants the opportunity to test ideas in the classroom and to share the results with their colleagues. The workshops are planned, and in some cases conducted, by teams of teachers working with colleagues from industry and university communities. The workshops are administrated by teacher coordinators, who also are responsible for ensuring that workshop ideas are field-tested and that the results are shared. The coordinators are either Teachers' Council members or participants in prior workshops who volunteer to assume a leadership role. Coordinators are trained in cooperative learning techniques to facilitate discussions about field-tested ideas and to encourage the exchange of teaching strategies. They meet after each session to evaluate and to assess progress toward workshop goals.

This year, seven half-day workshops were held over a period of four Saturday mornings: November 5, December 10, January 21, and February 18. Workshop topics included: Explore and Discover the Magic of Math and Science; Depicting and Predicting for Quantitative Literacy; the Geometric Supposer, Geometry: Manipulative Mania; Turn on the Calculator and Turn on Your Students; FUNdamentally Mathematics; and How the Yellow Pig Got Big, which focused on the NCCSM Pre-calculus software. An eighth workshop, Software for the Mathematics Classroom, was offered but not held due to low registration. The limited registration was attributed to an incomplete description of this workshop in the registration materials.

The +PLUS+ Workshop Series is designed to emphasize the importance of the teacher as interpreter and refiner of new ideas in the mathematics curriculum; to foster the exchange of creative ideas that stimulate and enliven the teaching of mathematics; to promote teachers learning from teachers and evaluating one anothers' ideas; to provide models of lessons that teachers value; and to encourage increased participation by industry and university colleagues. During the weeks between workshops, participants practiced and applied the new ideas and methods in their own classrooms and reported their results at the following sessions. With the exception of the November workshop, which began with an orientation, each of the sessions opened with an opportunity for participants to share field-tested ideas.

Workshop activities included strategies for translating new information into classroom use and for creating and field-testing lessons and instructional materials. Each workshop participant developed a Teacher Resource Book for his or her own use. These books included ideas, field-tested lessons, worksheets, lists of material resources, bibliographies and lists of guest speakers. The producer of the best field-tested idea from each of the seven workshops received a $200 Professional Development Grant. As in 1987-88, the award-winning ideas will be published. This year the collection will be called "The Best Field-Tested Idea Book from the 1988-89 +PLUS+ Workshop Series." The booklet will be distributed to workshop participants, principals, department chairs, and district instructional staff in spring, 1990.

In total, 97 teachers of grades 7-12, representing 52 schools in ten districts, participated in the 1988-89 +PLUS+ Workshop Series. These teachers had the opportunities to observe, develop, evaluate and integrate new materials and methods into their mathematics programs and were encouraged to assume responsibility for change. As in the previous +PLUS+ Workshop Series, participants earned one salary-point credit from the Los Angeles Unified School District, or professional expert pay of $150, paid by each teacher's school district. The districts also paid the stipend for the presenters.

## +PLUS+ Workshop Planning Committee Meeting

The Workshop Planning Committee met on August 9, 1988, to prepare for the third +PLUS+ Workshop Series. Eleven committee members attended. The purpose of the meeting was to finalize the design and format of the workshops, to determine the presenters and teacher coordinators and to clarify their roles, to revise the Evaluation and Field-Tested Idea forms, to prepare workshop descriptions, and to schedule future meetings.

Presenters also met independently to prepare for their workshops. For example, presenters of the workshop "Explore and Discover the Magic of Math and Science" met July 29 and held a dinner meeting on September 28 to finalize plans for their presentations. At these meetings, the presenters decided to encourage teachers to register for their workshop in pairs (of one science teacher and one mathematics teacher) from the same school. The two teacher coordinators for this topic had participated in the 1987-88 Workshop Series.

## +PLUS+ Workshops Site-Meeting

On October 20, 1988, 12 of the teacher workshop coordinators and presenters met at Wilson High School, the site of the 1988-89 +PLUS+ Workshop Series, for a training session to help them better understand their role and responsibilities in the upcoming workshop series. The training also provided them with strategies for conducting feedback sessions and small-group discussions. As in the previous year, Robin Gostin, a mathematics teacher at Fairfax High School and a promoter of cooperative learning, directed the training session. In addition to the training, the coordinators and presenters finalized plans for the workshop series. The on-site observer reported that the meeting ". . . was successful and Robin Gostin was helpful."

## November 5 Workshop

The first workshop in the series was very well attended, with 95 teachers participating and one representative from higher education serving as a presenter. The teachers were very excited and enthused about the workshops, seemed to recognize the importance of the concept of field-testing ideas, and appreciated the interactive hands-on format. On the evaluation forms teachers completed at the end of the workshop, the range of ratings across sessions was 3.25 to 3.80 on a 4-point scale, with 4 being the most positive rating. The overall average rating was 3.52. One teacher commented, "I realized during the presentation that I could allow my students the same opportunities for problem solving and expression of ideas that we were given during the workshop. I experienced an increase in awareness and self-esteem which I would like them to also experience." Another added, "Whenever teachers help teachers, the results are always positive." The on-site observer said, "The first workshop was a success and everyone left happy. Lots of prep time and good presenters make them [the workshops] successful."

### December 10 Workshop

Eighty-five teachers participated in the December 10 workshop. The ratings for the sessions at the December workshop ranged from 2.88 to 3.85 with an overall average score of 3.53 on a 4-point scale, with 4 as the most positive rating. Teacher's comments were enthusiastic. One teacher said, "I love it so far. I need lots of ideas that I don't have to put too much energy into . . . . I like the sharing of field-tested ideas. I bring mine to share and take ten back with me." Another added, "I want to thank Susan for helping me change my entire school around to using calculators. That was a really nice thing about the workshop last month."

Comments from the presenters included, "Excellent field-tested ideas. I was so impressed"; "Light years better than last year. People actually did what they said"; "Outstanding group. This year's is doing geometry; last year's watched." A presenter from industry said, "I was impressed with my group's responses. There was a mix of grade levels with lots of sharing and enthusiasm." Another said, "Excellent this time; much more comfortable. We are sharing outstanding ideas. I like when my group explores and then shares." The on-site observer noted, "The workshop went well. It seems this year's participants are coming more prepared and willing to share their ideas. It is exciting."

### January 21 Workshop

Sixty-eight teachers attended the January 21 workshop. In addition, two business representatives presented the "Explore and Discover" session. The average rating given by participants was 3.28 on a 4-point scale, with the ratings for individual sessions ranging from 2.25 to 3.83. One teacher said, "The comfortable atmosphere in the class encourages voluntary contributions from participants; the written material is pertinent, appropriate and highly useful." Another appreciated the "class testing materials, and exchange of ideas that work with the class." Other comments indicated that teachers especially valued the information they received and the interaction with other teachers. One of the presenters commented, "The program went well and lots of ideas were shared."

## February 18 Workshop

The final workshop in the 1988-89 +PLUS+ Workshop Series was held February 18, 1989. The workshop was attended by 79 participants, including 60 teachers and 19 representatives from business, industry and the school districts. Ratings for individual workshop sessions ranged from 2.68 to 3.90 on a 4-point scale, with an average rating of 3.49. The teachers felt that the sessions were stimulating, interesting and useful. One teacher commented, "All these sessions have been highly professional yet simultaneously comfortable so there is a genuine sharing of ideas and experiences." Another added, "I liked sharing ideas, techniques, comments, and useful motivating ways of teaching geometry." A third noted, "Hands-on activities for teaching the often boring unit on measurement are making it interesting for greater retention by students."

## Workshop Evaluation Meeting

On March 30, 1989, eight teachers and the collaborative project director and coordinator met at the LAEP office to assess the 1988-89 +PLUS+ Workshop Series and to make recommendations for the 1989-90 Series. Topics of consideration included the need for new subjects; the high quality of the field-tested ideas; use of outside resources; dealing with diverse backgrounds; and involving more teachers. In addition, participants recommended which teachers should receive $200 grant awards for the best field-tested idea in each session.

In general, everyone agreed that the series was a success and needed only minor adjustments. The teachers were impressed at how well the workshops were received, but also were ready with suggestions for improvements. One teacher said, "I was surprised by the quality of field-tested ideas. They were great. We needed more computers in our program. It was a major weakness. The participants were a neat group of people. I enjoyed sharing with them." Another added, "I would like a materials budget. It went very well; people were challenged and interested in the workshops. The group was certainly diverse." The collaborative project director commented: "This year's workshops were outstanding. The field-tested results were better than last year. I think it's an evolutionary process. The field-tested booklet was tough to put together. Many people edited and some comments were picky. The workshops were successful because of the role of the coordinators. Also, it's teachers teaching teachers. Do we get teachers working with materials from industry to help develop these materials for the classroom? . . . . I've learned not every teacher can take an idea from a non-teacher and make it work." The improved quality of the field-tested ideas has been attributed to a number of factors, including the availability of examples, the teacher coordinators' enhanced sense of responsibility for collecting the ideas, the provision of a $200 incentive award, and better-defined expectations.

### New +PLUS+ Schools' Department Site Meetings

Beginning in November, 1988, department site meetings were scheduled at each of the new 1988 +PLUS+ schools. Meetings were held each month, arranged by the host school. The meetings, which ran from 4-6 p.m., included dinner. Teachers from all 15 +PLUS+ schools were invited to attend. The purpose of these meetings was to help integrate the new schools into the already existing +PLUS+ network and to explore various topics in mathematics education that were identified by each new school. They also provided an opportunity for teachers to meet with district staff to share concerns and ask questions. At priority-staffing schools, teachers were eligible to receive staff development credit for attending these meetings, at the discretion of the principal.

The first +PLUS+ Department Site Meeting was held at Dorsey High School, from 4-6 p.m., on November 14, 1988. Nineteen people attended the meeting, including 15 teachers representing nine schools, two school administrators, the collaborative director and the on-site observer. The meeting focused on a discussion of the district's policy and criteria for placing students in Algebra IAB. Phil Nassief, director of instruction for the Senior High Schools Division, was present to hear concerns and answer questions regarding district policy. The on-site observer reported, "It was an important step for district people to meet at a high school where at least ten schools are represented. The more each school listens to other math programs, the better they will become. The more districts listen, the quicker the reform." One teacher commented, "These site meetings could be the start of some positive changes. I don't know how Toby got the district people to come but I'm glad she did. They need to know how we feel." Another added, "This was definitely not a waste of time. I actually learned something. The district people do exist and they did not seem hostile. That's a good sign."

The second department site meeting was held at Fremont High School on December 12, 1988. During the first half of the program, the principal presented an overview of Fremont's strategies for improving its mathematics program. The remainder of the program focused on strategies to increase student enrollment in Algebra I. Teachers were encouraged to share successful strategies they had used at their schools to prepare students for Algebra I. Fifteen teachers and several school administrators and district representatives attended. Reactions to the meeting were mixed. The collaborative project director said, "It was an outstanding meeting. It is good for district people to hear what teachers are saying." However, a teacher attending the meeting commented, "The meeting seemed unfocused. Fremont just told what they were doing in their math department."

The third site meeting was held on January 23, 1989. Hosted by Belmont High, the meeting was held at UNOCAL, Belmont's Adopt-a-School partner. The meeting was well attended, with 46 teachers representing eight schools, two administrators and four district staff participating. Following an overview of Belmont's mathematics program, +PLUS+ teachers presented successful strategies to increase student success in mathematics, including the use of calculators, manipulatives, cooperative learning and the computer in the classroom. Comments after the meeting were positive. One teacher said, "This was an excellent workshop. It kept moving and held my interest." Another teacher noted, "Food was great, lessons were great and I want to attend another." A LAUSD Mathematics Advisor remarked, "I enjoyed this session . . . first-class job." The on-site observer reported, "These site visits have been one of the best ideas to come from +PLUS+. They bring district people and teachers from many schools together to share ideas. It also gives the hosting school a chance to show off and work together."

The fourth site meeting was February 27, 1989, at Huntington Park High School. Forty-eight people attended, including 42 teachers, two administrators, and four Huntington Park students who participated in peer tutoring demonstrations. Dinner was followed by an overview of Huntington Park's +PLUS+ plan, and presentations on the use of graphing calculators and manipulatives in Algebra I. Participants were very pleased with the event. The on-site observer reported that participants left with an activity for the next day. One teacher commented, "This is my second site visit and they have taught me a great deal. I can use this with my algebra class. Food was great, but the lessons were even better." Another added, "The whole show was impressive. In particular, I was delighted to have students at this meeting. They added another dimension to these meetings."

The fifth department site meeting was held March 27 at Crenshaw High School. The evening began with an overview of Crenshaw's +PLUS+ plan, followed by demonstrations on using computers and graphic calculators, including one by Project Director Toby Bornstein. Thirty-six teachers and administrators attended.

The sixth and final site meeting was held April 24 at University High School. Thirty-eight people attended. The meeting included a summary of University High School's involvement with +PLUS+, reports by NCTM conference attendees, and a demonstration on the use of software for all levels in the mathematics classroom. Software for all levels and manipulatives for algebra and geometry were available for inspection.

## Demonstration Lessons

The +PLUS+ Teachers' Council planned a series of nine on-site classroom demonstrations for +PLUS+ teachers during spring, 1989. The demonstration lessons were designed to offer teachers an opportunity to focus on effective teaching strategies, classroom environment and interaction, and curriculum. Eleven teachers volunteered to be presenters and nine on-site demonstrations were scheduled. The visits were scheduled at Webster Junior High School, Mountain View High School, Fairfax High School, Morningside High School, Wilson, Huntington Park, and Manual Arts. Each teacher was to host a maximum of ten teachers who would observe his/her class in action. Afterwards, the teachers were to have an opportunity to discuss what they observed with the presenting teacher, with the +PLUS+ coordinator facilitating the discussion. Each session, including the lesson and discussion, was to be videotaped. Topics for the demonstration lessons were to include cooperative learning, calculator use, the Geometric Supposer, NCSSM pre-calculus materials, ESL mathematics, peer tutoring, "no book" geometry, integrating computers in the mathematics class, and geometry manipulatives.

Visiting teachers received substitute coverage and mileage reimbursement. Teacher-presenters received two hours of professional expert pay from +PLUS+ for the preparation of the demonstration lesson. +PLUS+ also provided substitute pay to enable presenters to participate in discussions.

Due to the Los Angeles teachers' strike, only two site demonstrations were held, one at Morningside and one at Webster. The project director reported that the demonstrations were a worthwhile experience for the ten teachers who were able to participate; three on the first visit and seven on the second. The on-site observer also noted that the demonstration lessons were a valuable experience for the students as well as for the teachers; the demonstration lessons enhanced student self-esteem and confidence in their teacher, and heightened their involvement in the lesson. The demonstration at Morningside High School focused on using graphing calculators in the classroom. Seven +PLUS+ teachers attended, as well as the collaborative coordinator. One teacher commented, "I enjoyed being in class working with students." Another teacher commented, "This calculator is great! We need to have one." Overall, the teachers attending the lesson rated the value of the demonstration a 2.9 on a 3-point scale.

### Jaime Escalante Awards

The Jaime Escalante Mathematics Teacher Awards, sponsored by the +PLUS+ Project under a grant from the ARCO Foundation, were presented April 18, 1989, in the Yukon Pacific Room of ARCO. ARCO provided the funding for the awards and hosted the reception to honor the winners. Conceived by the +PLUS+ Teachers' Council in spring, 1988, the awards program sought to reward teachers who have instilled in students a desire to achieve in mathematics. In the spirit of Jaime Escalante's efforts to motivate students who are historically underrepresented in the mathematics field, the award program was designed to honor teachers who foster in students a belief in their own ability to succeed, a sense of responsibility for their own learning, and an appreciation for the value of learning mathematics.

This newly created award elicited more than 500 nominations from current and former LA County public school students who wrote essays on their teacher's unique qualifications. Any junior high or senior high school mathematics teacher currently teaching in the Los Angeles County public schools was eligible for nomination. The deadline was December 10, 1988.

On March 8, a selection committee comprised of teachers, school administrators, parents, guidance counselors, business representatives and students met to review the nominations and to select ten finalists. On March 29, the finalists were interviewed by three different panels comprised of corporate, community and education leaders. Based on these interviews, the three teachers who were to receive the $1,000 awards were chosen.

The awards ceremony included opening remarks by Mr. Kenneth Dickerson, Senior Vice President of Government Affairs at ARCO, and Mr. Erwin Tomash, Retired Chairperson of Data Products, LAEP Board Member, and co-chair of the Urban Mathematics, Science and Technology Committee. Jaime Escalante was the keynote speaker and participated in the presentations of the awards. Two award winners, Lorrie Freedman and Chip Healy, are collaborative teachers. Lorrie Freedman commented that she "felt so honored to have received this award." Chip Healy said he was "so moved by what his student wrote that he had tears in his eyes at the interview." ARCO was so impressed with all of the finalists at the award ceremony, the corporation decided to grant each of the seven semifinalists $500.

## First Annual +PLUS+ Conference

The first annual +PLUS+ conference, "Moving Towards the Future," was held Friday, April 28, and Saturday, April 29, at the Marina International Hotel in Marina del Rey. +PLUS+ team leads and mathematics department chairs were invited to the all-day session on Friday and all +PLUS+ teachers were invited to participate on Saturday. +PLUS+ arranged for the districts to provide substitute coverage for Friday.

On Friday, April 28, the team leads and department chairs met in an extended Teachers' Council meeting. After lunch, Collaborative Director Toby Bornstein spoke about her "Vision of the Future." The audience then broke up into brainstorming groups to address issues of communication, permanence, leadership and evaluation. At the close of the afternoon, the facilitators summarized the results. A total of 31 participated in the first day of the conference, including 23 teachers who were either team leads, department chairs or representatives from the 1988 schools; the collaborative project director; and the collaborative coordinator.

Fifty people, including 47 teachers, the collaborative director and the collaborative coordinator, attended the Saturday conference. The program began with four mini-workshops on the latest available technology: graphing calculators, math videos, the Geometric Supposer and other mathematics software. After lunch, Dr. Jack Price, Superintendent of Schools for the Palos Verdes Peninsula Unified School District, spoke on the future of mathematics education. In the afternoon, the 14 schools in attendance met by department. The focus of these meetings was to evaluate what had happened during the year and to look ahead to the goals for the coming year. In their discussions they addressed four questions: What were the objectives of your original plans? What steps were implemented to achieve the desired outcomes? What barriers were encountered? What was accomplished which was not in the original plan?

At the end of the day, the team leads reported back to the entire group and, based on the responses to these questions, conference participants voted to decide which 1988 +PLUS+ departments should receive the five implementation awards of $250 for the progress they had made on their action plans. The $250 awards were to be used at the departments' discretion. Four departments received awards. The department from Huntington Park High School received two awards, one for "Best Use of Faculty Talent" for sharing ideas among department members and one for "Most Widely Networked Idea" for bringing in speakers and starting a newsletter. The Bell mathematics department received the "Most Effective Use of Outside Resources" award for obtaining outside funds. The Belmont mathematics department received the "Most Dramatic Change in Student Behavior" award for increasing student attendance by 10 percent through bilingual peer tutoring during lunch and through mathematics contests. The Fremont mathematics department received the "Best Use of Outside Funding" for receiving a Teacher Achievement Award Project grant from the Chancellor's office of California State University. The $5,000 award is to implement a "Learning by Doing" project, which will help basic mathematics and high school mathematics students prepare themselves for higher mathematics courses through the use of manipulatives. The department also had applied for, but did not receive, a GTE GIFT grant.

In general, teacher comments regarding the Saturday session were very favorable. One teacher said, "I enjoyed the graphing calculator demo and the uses of it in the classroom. The math videos were interesting but not organized. Geometric Supposer I heard before but it was a good presentation." A second teacher remarked, "Very nice atmosphere and very relaxed. I enjoyed communication with other schools. I have a new attitude to return to the work site. Good food, very informative. Workshops were good." A third teacher added, "The mini-sessions went well even though we had time constraints, teachers were exposed to new ideas." A fourth teacher commented, "Improve on choice of day, I haven't had a free Saturday this month. Too bad we couldn't provide release time during the week. Outside of that I enjoyed myself and learned some new things."

Collaborative Project Director Toby Bornstein commented, "After all that hard work and many planning sessions, this was an outstanding success." The on-site observer reported, "This activity went better than I expected. The one thing for me that stands out is how very powerful we are when we communicate and act accordingly. Teachers left feeling like they were part of something important. It's clear we do care about each other and our profession. I feel they had a good time and learned more than math content."

## Woodrow Wilson Geometry Institute and Follow-up Workshop

The collaborative sponsored a Woodrow Wilson Geometry Institute, August 1-5, 1988, with funding from the Los Angeles Unified School District and the Los Angeles Educational Partnership. The Institute focused on new approaches to teaching geometry; presentations addressed new directions in the content and teaching of high school geometry. The Institute, held at the Osage Professional Development Center, was scheduled from 8 a.m. to 5 p.m. each day. In addition, a dinner reception was held Thursday evening for the participants and presenters. Twenty-six participated in the Institute, including 17 teachers, seven LAUSD district staff, one staff member from LA county, and one teacher from Wisconsin. Teachers received a waiver of the $125 registration fee and a choice of either two LAUSD salary points or a $300 stipend that was provided by the LAUSD. Participants also were given various materials that had been developed during the Institute. Because the district was unable to pay the registration fees, however, +PLUS+ allocated the funds.

Participants were very enthusiastic about the Institute. One teacher commented, "It was good to have the district people there. They saw first hand how much a teacher has to prepare and learn for class. I think we gained their respect. They saw how high powered some of the teachers can be. On the other hand, teachers gained respect for district people . . . . It was a great exchange." Another teacher added, "We learned so much. I hope I can fit it into my school plans. I am not afraid of geometry anymore." A third teacher commented; "I wish it would have been longer than one week. I was having such a good time. All teachers need to go through this." As a result of the teachers' interest, a workshop using the materials that had been presented at the Institute was offered as part of the 1988-89 +PLUS+ Workshop Series.

A follow-up session for teachers who attended the Institute was held at Venice High School on Saturday, March 11. Lew Douglas of the College Preparatory School in Oakland, who was one of the Woodrow Wilson master teachers, presented extensions of what had already been developed. Most of the time was devoted to participants' presentations of the ideas they had field-tested during the year. Several teachers who had attended the 1988-89 +PLUS+ workshop series on geometric manipulatives also participated in this follow-up workshop.

## Teacher Associate Pairs (TAP) Program

The Teacher Associate Pairs (TAP) program was initiated during the 1986-87 school year to foster meaningful interaction between high school mathematics teachers and mathematics professionals in the world of work. The program began as an experiment that paired Hughes Aircraft retirees with +PLUS+ teachers to identify appropriate topics and effective forms of interaction between teachers and practicing mathematicians in the "real world." An initial meeting of teachers and retirees resulted in frequent telephone conversations among participants, and a "buddy system" soon evolved. Additional Hughes retirees and active employees volunteered, and a meaningful link in the school-industry network was forged.

During the 1987-88 school year, TRW employees joined the TAP project. This expanding interaction between teachers and other mathematics professionals is beginning to help mathematics come alive in the classroom and to contribute significantly to the growing knowledge pool of +PLUS+ teachers. It is the program's goal to establish a widening network of TAP associates accessible to all +PLUS+ teachers, with 100 teacher participants in TAP by 1991. Because of the nature of the program, it is difficult to determine the number of contacts made between Teacher Associate Pairs. It is known that two associates did make a presentation at Huntington Park.

### IISME (Industry Initiatives in Science and Mathematics Education)

Initiated in the summer of 1987, IISME enables secondary mathematics and science teachers to apply for salaried positions in industry or university research during the summer months. These teachers work with peers from industry or the university to model today's science and mathematics applications and research for classroom use.

During the summer of 1987, LAEP's pilot program provided seven teachers (including four from +PLUS+ departments) with the opportunity to work in industry. Fifteen positions in industry were filled by teachers in the summer of 1988. Industry participants included the Department of Water and Power, IBM, GTEL, Kendall McGraw (Medical research and development), Northrup Research and Technology, Pacific Bell, UNOCAL, USC, Xerox, and LAEP.

### TELE-Venture

During the 1987-88 school year, +PLUS+ arranged for the seven +PLUS+ departments to receive modems, software, and telephone lines to link into the electronic bulletin board TELE-Venture. During 1988-89, the seven new +PLUS+ schools and Manual Arts were added to the network. The telecommunication system, a program of the LAUM/S/TC, offers teachers the opportunity to exchange information as well as to participate in forums on critical issues affecting mathematics teachers. In addition to the teachers in the 15 +PLUS+ departments, several science teachers and district instructional specialists use the network, and all TAP associates are being encouraged to participate in TELE-Venture.

### Grants

#### LAEP Small Grants Program

The LAEP sponsors a Small Grants for Teachers program to stimulate creativity in classroom projects. Since its creation in 1984, the program has awarded more than $610,000 to 1,622 teachers in 500 schools. Three +PLUS+ teachers received grants in the fall of 1988: Fred Boobar from Verdugo Hills Senior High School; Barbara Wills from Huntington Park Senior High School; and Martin Solig from University Senior High School.

In the spring of 1989, to celebrate five years of innovative classroom ideas developed by teachers, LAEP offered one-time only Anniversary Grants to former grant recipients whose projects were selected for being most worthy of replication. The 100 awardees received $200 each to write about their grants in a "how-to" fashion. +PLUS+ teacher Mike Dacker was one of the teachers selected to receive an Anniversary Grant.

Each year the LAEP sponsors a free Workshop Fair at which teachers present their award-winning projects. Recipients of the Anniversary Grants presented workshops on their projects at the fair, which was held from 8 a.m. to 4 p.m. on June 29 and 30 at the University of Southern California. More than 100 K-12 workshops were offered, including mathematics, computers, bilingual/ESL, grant writing, industrial, technology, self-esteem, special education and technology. Many of the workshops were interdepartmental. One LAUSD salary point credit was offered for attendance.

## Professional Development Grants

The +PLUS+ Teachers' Council offers Professional Development Grants to enable teachers to attend regional and national conferences. During the 1988-89 school year, a total of $11,330 was awarded to 20 teachers to attend the Phillips Exeter Academy, The National Conference of Teachers of Mathematics (NCTM) Annual Meeting and Apple Fest '88. Teachers from the new 1988 +PLUS+ departments were guaranteed opportunities to attend conferences using the Professional Development Grants. Teachers from the continuing departments had to apply to the Teachers' Council for funds to attend events that support their departments' continuation proposal. The Teachers' Council reviewed the requests and determined which department and individuals would best be served by attendance. A major consideration in selecting grant recipients is the benefit to the entire +PLUS+ network. Individuals also may apply to the Teachers' Council for up to $200 in matching grants for assistance to attend conferences. In return for this support, a teacher returning from a conference is expected to share information with his or her department and to make a presentation to the Teachers' Council. Teachers were encouraged to apply for the Woodrow Wilson Institutes, the California Mathematics Projects, the National Endowment for the Humanities and the National Science Foundation grants.

## National and Regional Conferences

### California Mathematics Council (CM) Southern Section Conference

Eight +PLUS+ teachers from four high schools received Professional Development Grants to attend the California Mathematics Council (CMC) Southern Section Conference November 18-19, 1988. Substitute teacher coverage was provided by the district. In addition to these teachers, 20 other +PLUS+ teachers attended the conference at their own expense. Five +PLUS+ teachers were presenters.

### Phillips Exeter Academy

The Fifth Annual Conference on Secondary School Mathematics and Computers at Phillips Exeter Academy was held June 25-30, 1989, in Exeter, New Hampshire. Eight +PLUS+ teachers, including a representative of each of the seven 1988 +PLUS+ departments and one teacher at large selected by the Teachers' Council, received Professional Development Grants to attend. Substitute teacher time for teachers attending year-round schools was provided by the individual teacher's school district.

Participants reported that the conference was a wonderful experience. In an article that appeared in the +PLUS+ newsletter, one teacher wrote, "After dinner, exciting lectures such as 'Chaos, Fractals and Dynamics' by Dr. Robert Devaney of Boston University and 'Universal Design Pattern' by Ms. Martha Boles of Pythagorean Press, were given. Afterwards the floor was open for questions, giving listeners the opportunity to interact with these forerunners of modern mathematics. The usefulness of the lectures could never be over-exaggerated!" Another teacher wrote, "I tried to do and see everything with a vengeance. I knew that never again would I find such a wealth of information and interesting people and ideas in one place and this magic week seemed to beckon with a power stronger than common sense or human frailty. Thank you everyone, for making it possible for me to participate. The ideas will be useful throughout my professional life, the new friends and colleagues will continue to enrich my experience, and the memories will stay with me forever."

## National Council of Teachers of Mathematics (NCTM) Annual Meeting

Nine +PLUS+ teachers representing nine +PLUS+ departments received Professional Development Grants from the collaborative for both travel and lodging expenses to attend the annual meeting of the National Council of Teachers of Mathematics (NCTM) in Orlando, Florida, April 12-15, 1989. One-half of the expenses for a tenth teacher, representing a tenth school, was also provided. Collaborative Project Director Toby Bornstein and On-Site Observer Richard Curci also attended the meeting, along with five other teachers who had their way paid from other sources. Since the conference was during spring break, release time was not needed.

The conference theme was "Vision for the World of School Mathematics." During the day the teachers attended a wide variety of sessions. In the evening, they participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Curriculum and Teaching Program.

The teachers enjoyed the conference. One teacher wrote, "The excitement generated by all the math teachers was unbelievable. It was interesting being able to talk with other teachers from across the U.S. and other countries and discuss their math programs. I found out that some of the problems that I thought occurred only at my school turned out to be nationwide." Another teacher reported, "There were many highlights and benefits for that week in Orlando. The sheer number of math teachers from around the country and the world was overwhelming. The sense of community and professionalism in that group and most especially in the Los Angeles contingent sent by +PLUS+ was evident. It was a wonderful event and I am very grateful to have had the opportunity to go and very proud to be a part of this collaborative."

Some of the teachers expressed disappointment in the UMC-sponsored meetings. In regard to the Wednesday evening reception, they commented that teachers did not have the opportunity to meet teachers from other collaboratives. They also remarked that the structure of the Wednesday evening reception assumed that the teachers would know people who have been associated with the project for its duration, not taking into account that this was the first UMC gathering for several of the teachers. In regard to the equity meeting on Friday, teachers felt that the goal of the meeting was not clear.

### Apple Fest '88

The +PLUS+ Teachers' Council awarded a $200 Professional Development Grant to a teacher from Wilson High School to attend the Apple Fest '88 Conference held in San Francisco in September. Upon the teacher's return, he made a presentation to the Teachers' Council, reporting that the conference helped to enhance his knowledge of computers and telecommunications.

### Space Shuttle Launch

A +PLUS+ teacher received a grant from the Teachers' Council to see the space shuttle launched. The $410 grant covered only transportation.

### Collaborative Newsletter

The collaborative initiated the publication of a monthly collaborative newsletter NON +PLUS+ ED in April, 1989. The newsletter is designed to keep collaborative members involved and informed by providing +PLUS+ participants a means of sharing innovative teaching strategies and concepts, and of communicating events of interest to the general membership. The newsletter is distributed to all +PLUS+ teachers and district staff, as well as to those in the UMC network. All +PLUS+ members are encouraged to contribute to the newsletter by sending information or suggestions through TELE-Venture, in writing or over the phone, to the editorial staff. The editorial staff is comprised of Teacher Coordinator Kathy Blackwood, Administrative Assistant Debbie Novick, and +PLUS+ teacher Jim Wigton. The name for the newsletter was selected by the Teachers' Council from entries submitted by +PLUS+ teachers; the person who submitted the winning entry received a stereo headset radio.

The first issue of the newsletter highlighted collaborative events, including the Jaime Escalante Awards, the Third Annual Workshop Series, the NCTM Annual Meeting, and The Woodrow Wilson Follow-Up Workshop. The newsletter also contained a description of the Teachers' Council, an article highlighting some of the benefits of participation in +PLUS+, an update on the newly recruited +PLUS+ class of 1989, and an article by a teacher discussing the impact +PLUS+ has had on his teaching.

The second issue of NON +PLUS+ ED included an update on the Escalante Awards; an overview of the +PLUS+ Retreat; a description of the Huntington Park High School Math Fair; a discussion of the +PLUS+ Site Demonstration; a listing of professional development opportunities for summer, 1989; an announcement of the 1989 +PLUS+ departments; announcement of various awards won by +PLUS+ teachers; and a list of important dates.

## E. Observations

### Project Management

The Teachers' Council evolved over the 1988-89 school year from a collection of representatives who discussed issues to a governing body with its own formal structure. The evolution began in December, 1986, and has taken nearly two years to reach its current status, in which teachers provide the leadership for the Council and make the major decisions for +PLUS+. The most recent evolutionary developments did not occur without some of the inevitable tensions that accompany such growth and change. In the beginning of the school year, the Council had some difficulty focusing discussions on specific topics; as the year proceeded, however, the meetings became more focused. After the October meeting, one teacher observed, "We have narrowed our focus and today we are working like a Council and making progress." Teachers recognized that some of the decisions that the Council would make were not going to be easy ones. In regard to the November meeting, for example, a teacher said, "Coming up with an evaluation tool is going to be a tough undertaking, but we have to try it." After the February meeting, a teacher noted, "Our decisions are getting more and more difficult to make, like deciding on who stays or goes to a conference or whose proposal should be funded." Individual Council members did not always agree with all decisions, but they believed in the process enough to pursue an idea and to gather the information necessary to try to persuade others of their own point of view. In reaction to a discussion at the November meeting, a teacher remarked, "For some reason, I can't get the Council to see that a time management workshop would be beneficial to teachers. I'm going to keep trying. Maybe next time I'll have more information for them."

With the increased empowerment of the Council, the meetings began to serve as a forum for members to engage one another in discussions of key issues. "I liked [the meeting] because it's a mentally active environment," commented one teacher about the

June meeting. As a consequence, however, sometimes the meetings extended beyond the designated two and a half hours. The +PLUS+ coordinator reflected on the June meeting, "Too long. We spend too much time. Maybe [we could have] more frequent meetings or limit our agenda. We have to get sub-committees going." Despite these concerns about efficiency, some members began to appreciate what the Council could do and what influence it could have on teachers. After the April meeting, a teacher reflected, "Sitting here I realize how powerful and important the Teachers' Council can be--Teachers directing their futures by making major decisions on professional development and enrichment."

Planning for the April retreat also created some tension. Although initial plans were developed a full year in advance, final decisions were made less than three weeks before the event. This caused some anxiety for the director, who was faced with the dilemma of deciding whether to intervene or to let the process continue with the possibility that the event would not succeed. The director had engaged a consultant in January to work with the Retreat Committee; she also personally convened the committee during the NCTM Annual meeting in Orlando. While in prior years she had been in charge and provided direction, she was unsure as to her role under current conditions. She considered--but did not actually employ--such techniques as guiding discussion to focus on issues or identifying specific tasks that needed to be accomplished. The end result was a successful retreat that had been planned by the teacher committee under the guidance of the coordinator.

The +PLUS+ Teachers' Council serves several purposes. It is, first and foremost, a decision-making body for the +PLUS+ project. Council decisions focus on program planning, fiscal concerns, teacher issues and allocations, and overall program direction. The Council also serves as a means by which teachers from different schools can network with one another. As such, the Teachers' Council meetings serve not only as a vehicle to conduct business, but also as an opportunity for teachers to become better acquainted with their colleagues outside the classroom setting. In addition, the Council assigns responsibility to teachers for collaborative planning and activities. Council members explore topics and report their findings at meetings of the whole. Committees, such as the Jaime Escalante Awards Committee and the Retreat Committee, are formed to address particular tasks. These mechanisms ensure that the work is shared among all members of the Council. As the Council matures and satellite Councils are formed, the issue of its approach and formality will need to be addressed; in short, should the Council's functions of promoting teacher interaction and participation be sacrificed in the name of greater efficiency in conducting business meetings?

The executive director of LAEP, who also serves as executive director of the collaborative, continues to be a strong advocate of +PLUS+ and has been able to intercede with the district on the collaborative's behalf. In March, for example, the executive director wrote a letter to the deputy superintendent that was influential in convincing the district to release Ms. Blackwood to serve as +PLUS+ coordinator. In April, Ms. Funkhouser wrote a letter requesting an interpretation of a School Board ruling that would allow some teachers to be released part time to serve as +PLUS+ teacher consultants. This capability of circumventing bureaucratic channels on behalf of the collaborative has been important. As +PLUS+ expands to a greater number of schools and the district becomes more actively involved in supporting teacher consultants and coordinators, the value of an influential outside advocate will become even more apparent.

The LAUSD's high level of commitment to the collaborative and its growth, as demonstrated by an allocation of $230,000 from the LAUSD budget, has been a positive impetus for the collaborative and the teachers. It should be noted, however, that this commitment has not occurred without some redirections. The bureaucratic hesitancy to release a teacher to fill the coordinator's position has already been noted. In addition, the collaborative was faced with a district policy regarding the enrollment of students in Algebra. The action plan of one collaborative department focused on expanding Algebra enrollments by enrolling all incoming ninth graders, regardless of their performance in eighth-grade mathematics. Students who were struggling at the end of the first five-week period were transferred to a pre-algebra class. While this plan doubled the enrollment in Algebra classes, it conflicted with a district policy that prohibited transferring students out of a class based on test scores. The policy reflected a concern that the practice would be discriminatory, since it was most likely that at-risk students would be transferred. The collaborative school had a large population of at-risk students and as a result of the plan, the proportion of at-risk students taking Algebra did increase. In the context of this situation, the district administrators were suspicious of the motivations and rationales +PLUS+ was ascribing to teachers and departments. Five future +PLUS+ departments had previously sent letters to the district regarding the Algebra policy; in addition, the +PLUS director attended a district meeting at which the district Algebra policy was described. These interactions helped to build trust between the collaborative and district administrators. It appears that the financial backing that +PLUS+ receives in its drive for permanence comes at a cost of some of +PLUS+'s autonomy.

## Collaboration

Collaboration through +PLUS+ continues to energize mathematics departments and increase interaction among teachers from +PLUS+ schools. This is an important outcome of the strategy that requires new +PLUS+ departments to work together to submit an action plan. To nurture this interaction, +PLUS+ decided to offer continuation grants to departments that had successfully implemented their original +PLUS+ plans. The experience of planning and working toward a goal has brought teachers together in departments in which there had not previously been a great deal of interaction. The practice of having some teachers serve as facilitators and guides in the training and planning sessions enhances the advantages that are inherent when teachers work with their colleagues from other schools. TELE-Venture provides a means by which teachers can continue to communicate outside of planned meetings. Teachers recognize that +PLUS+ has initiated a series of actions and programs that reduce the isolation of teachers both within and among schools. In response to a question about the influence of the collaborative on forming relationships with other teachers, a department chair said, "+PLUS+ has brought the math department together as a whole, cohesive unit. The level of interaction has increased and morale is up."

Collaboration between teachers and representatives from higher education and business has also occurred, but is more specific to individuals rather than generalized to all +PLUS+ teachers. Primary opportunities for cross-sector interaction included the +PLUS+ Workshop Series and the Teacher Associate Pairs. In July, 1987, a committee was established to plan a workshop series on exploring science with mathematical modeling. The committee included representatives from industry, from higher education, from the district, and from +PLUS+. This type of planned interaction, as well as attendance at workshops presented by representatives from business and higher education, has made it easier for some teachers to discuss mathematics with mathematics professionals from other sectors. A teacher who is a frequent participant in +PLUS+ activities noted that as a result of the collaborative, "I'm more willing to discuss content and methods with colleagues at my school and other schools, as well as with business and higher education associates."

Site visits are yet another +PLUS+ activity that fosters collaboration among teachers from different schools. Site visits encompass both the 1988 +PLUS+ department meetings, which were hosted by each new school, and the site demonstrations, during which teachers could observe a +PLUS+ teacher presenting a lesson. The +PLUS+ department meetings encouraged networking among all +PLUS+ departments and provided support as the departments worked to implement their own action plans. The classroom visits provided a rare opportunity for teachers to share their professional talents and ideas with one another. These two forms of collaboration developed over time, and have been successful as a result of planning and cooperation. The +PLUS+ director and coordinator played essential roles in laying the groundwork upon which these programs were built. Releasing teachers to visit their colleagues' classrooms during school hours required a commitment from the district that included financial resources to pay for substitutes; this cooperation was obtained through negotiations with the district. The site demonstrations, however, were affected by outside influences, with seven of the nine visits cancelled because of the teachers' strike. The department meetings at the 1988 +PLUS+ schools required coordination among schools in order to develop a schedule for visits.

In developing its permanence plan, +PLUS+ considered the possibility of establishing a relationship with UCLA, which coordinates a California Mathematics Project for the area. It was suggested, for example, that UCLA could work with +PLUS+ in coordinating and operating the +PLUS+ workshops. There was already some level of interaction occurring between +PLUS+ and UCLA, as some +PLUS+ teachers participate in UCLA summer programs. An agreement could not be reached, however, as there was strong concern that UCLA would assume a leadership role, rather than a collaborative one, in its interactions with +PLUS+. This situation highlights the difficulty of collaboration at the program level in an attempt to merge existing programs, particularly if both programs are independently successful.

A permanence issue that all of the collaboratives are facing is recruitment: How can the program draw enough new participants to help maintain its vitality and energy? +PLUS+ has developed a process to identify and acculturate new departments into its programs in hopes that teachers from these departments will establish bonds and a sense of commitment sufficient to ensure their continued involvement. The system is designed so that teachers from the new departments spend time together during their first year, becoming acquainted. Only after this acculturation period is complete are the new departments permitted to have a representative on the Teachers' Council.

The new +PLUS+ teachers may have little understanding of the two-year struggle to bring the Teachers' Council into a position to make decisions for the collaborative. It remains to be seen whether the satellite Teachers' Councils will need to exert the same kind of energy to define their role. While the process was both time consuming and difficult, it was a critical catalyst for collaboration and for assuming ownership of the collaborative. The +PLUS+ strategy, a direct approach for acculturating new members into the program, appears to have a great deal of potential in this regard.

The +PLUS+ project provides rich examples of collaboration across a number of groups involving teachers, district administrators, and representatives of business and higher education. What is most apparent from the +PLUS+ experience is that developing collaboration requires a conscious effort, solid plans and persistence. Sustained collaboration does not occur simply by bringing people together; it requires a situation in which participants work together toward a common goal in a context in which the contributions of all participants are regarded as equally valuable.

Not all departments that initiate the process of becoming a +PLUS+ department actually continue; in some cases, a department drops out because its members are unable to agree on an action plan. In other cases, a lack of support from the principal or the transfer of a teacher who initiated the process are sufficient to terminate participation. It is not a foregone conclusion that all departments that complete the implementation of their action plan continue in the +PLUS+ project.

### Professionalism

Through +PLUS+, teachers have continued to develop professionally. Asked about the impact of the collaborative, teachers have noted an increase in self-esteem, a greater sense of self-worth, willingness to try new topics, greater participation in professional activities, and more assertiveness in decision making. While all phases of the +PLUS+ project contribute to areas of professional development, in 1988-89 the development of the Teachers' Council was the major impetus for enhancing professionalism.

The empowerment of the +PLUS+ Teachers' Council expanded the realm of what teachers can do. Through the Council, teachers planned, administered, and presented a successful retreat/conference. They made decisions and implemented the process of recognizing and honoring other teachers. They selected teachers to receive travel grants and served as mentors for teachers new to the process.

These changes did not occur suddenly, but evolved over time. Early in the school year, teachers were uncomfortable in their decision-making role. But as the months passed and they became more experienced, teachers became assertive to the point of disagreeing with the project director and convincing her to let them plan the retreat their own way. This supported the director's opinion that "you can't give people power, people take power."

There is no question that the Council's development into a decision-making body has been influenced greatly by the collaborative director. Ms. Bornstein has continued to compel teachers to make decisions and to follow through on them. The director insists that as the Council makes plans, the goal is clear and that barriers and solutions are identified. Teachers are challenged to collect information, to adjust plans and expectations, and to reflect on the event in order to determine the activity's impact. Each of the Saturday morning workshop sessions was followed by a debriefing lunch during which all leaders (teachers, as well as representatives from higher education and business) were expected to review the day's events and offer their reactions. These sessions were built into the process. The teachers who participate in the workshop series are expected to field test ideas and report their results; this is a prerequisite to receiving a stipend. Thus, the development of decision-making skills among members of the Teachers' Council has occurred at the tutelage of the director, who has continually stressed and modeled "planning, that leads to action, that is followed by reflection."

During the year, members of the Teachers' Council began to develop political acuity. This has resulted from a variety of situations. First, teachers have been directly affected by district policies that inhibited departments' action plans. Second, the director has encouraged teachers to evaluate program activities in order to generate evidence of +PLUS+'s value to the district. At the April retreat, time was devoted to issues of +PLUS+ evaluation; the discussion centered on strategies for impressing upon the district the collaborative's role as a supportive, nonthreatening institution. As a result of their increased sensitivity to political concerns, teachers have developed an expanded notion of teaching which includes exerting influence beyond the classroom. Asked about how participation in the collaborative has affected goals for teaching mathematics, a department chair who is a frequent collaborative participant responded, "Personal goals have expanded and now I want to make changes in the district's policy with respect to mathematics."

**Mathematics Focus**

The +PLUS+ project's mathematics focus has been driven by the California Framework. The content of the 1988-89 +PLUS+ Workshops Series was selected to address a range of topics covered by the Framework, including mathematics applications in science, quantitative literacy, an activity approach to teaching general mathematics, conjecturing in geometry using the Geometric Supposer, using manipulatives in geometry, using calculators in general mathematics and Algebra, and modeling using graphing calculators and computers in Algebra II. The mathematics topics that formed the focus of collaborative activities also have been influenced by information teachers have gained from attending conferences and institutes such as Phillips Exeter, the workshop held by the North Carolina School of Science and Mathematics, and the Woodrow Wilson One-Week Summer Institute. Topics of some of the departmental action plans also had a particular content focus, such as the use of calculators in Algebra or increasing student attendance in a specific course, but many of the spring 1989 action plans focused on issues of motivation. A common emphasis of all +PLUS+ activities is the generation of practical ideas that can be applied in classrooms and used with students.

Teachers report that participation in +PLUS+ has initiated changes in their classroom teaching. At least one teacher has created a new finite mathematics class. Others reported learning new techniques, using cooperative learning for the first time, being more sensitive about looking for mathematics in everyday applications, and being more conscious of regularly using a variety of strategies and manipulatives. A +PLUS+ teacher from Fremont High School was able to implement innovative mathematics projects as a result of three grants totaling $25,500 he received from area industries. He credited +PLUS+ with exposing him to the grant possibilities.

As a result of their involvement in +PLUS+, teachers are developing a broadened view of mathematics. By sponsoring activities and by fostering interaction among teachers and those from higher education and business, +PLUS+ has expanded teachers' knowledge of mathematical topics. "[+PLUS+] has made me extend my conception [of mathematics] beyond my narrow views," one teacher reflected. This expanding notion of mathematics and a willingness to try new approaches to teaching mathematics are impacting on students. Teachers report perceiving changes in their students that they attribute to new approaches they have implemented as a result of +PLUS+. These include increased awareness of new topics, a willingness to experiment, and a new recognition of the value of learning mathematics. One teacher observed, "[Students'] motivation level has increased due to the successful implementation of the +PLUS+ sponsored program and teacher participation in the +PLUS+ workshops." This teacher went on to note that +PLUS+, at least in part, has attributed to an increased student enrollment in the higher level classes.

The environment for professional growth created by +PLUS+ encouraged one teacher to experiment with teaching geometry by allowing students to develop their own textbook. It was his premise that the purpose for teaching geometry was to get students to think. Test scores indicated that these students performed as well on standardized tests as did students who were using a standard textbook. In addition, students' attendance improved and their interest in geometry increased. At the end of the school year, the students in this class were asked to share their thoughts about the class. One student wrote: "We've all changed with this class, but I consider myself one of the people that changed the most. I think I look at questions deeper, more seriously than I did before, even if it isn't a geometry question. I have learned that taking into consideration every possible answer/clue and not skipping anything gets you the answer. This class has helped me think, express my ideas, and how to get them across." Thus +PLUS+ has had an impact. Teachers are energized, they have made changes in their teaching, and these changes have prompted students to view mathematics in a new light.

### F. Next Steps

The basic structure of +PLUS+ will remain constant. Efforts will continue to encourage the district to release teacher consultants part time so that teachers can more effectively help other teachers. During the summer of 1989, teachers will be hired to create and analyze a +PLUS+ database and to produce a video. In August, a Woodrow Wilson One-Week Summer Institute will be held. Training in using TELE-Venture for teachers in the 1989 departments in year-round schools also will be offered in August. The +PLUS+ Workshop Series will begin in October, 1989; ten different topics will be addressed. Also in October, 1989, +PLUS+ will host the UMC Annual Conference. Participants will be invited to visit classrooms to observe +PLUS+ teachers. +PLUS+ will oversee the administration of the second Jaime Escalante Award, and teachers will again have the opportunity to apply for Professional Development Grants to attend both regional and national conferences. The collaborative newsletter will continue to be distributed monthly and will include a description of the wide range of +PLUS+ activities. Eight site demonstrations are planned for 1989-90, one per month. Topics will include algebraic manipulatives, the Geometric Supposer, "no-book" geometry, integrating computers in the mathematics class, and cooperative learning.

During 1988-89, the departments that joined +PLUS+ in 1989 will implement their action plans and the same process that has proven successful will continue to be used to identify departments to form the +PLUS+ class of 1990. In January, 1990, one teacher from each +PLUS+ school will participate in a special Leadership Conference. The Teachers' Council has identified key issues for discussion and a committee of three or four Council members has been appointed to address each topic. The topics and schedule for discussion for the first half of 1989-90 are: communications (August); professional development and continuation grants (September); funding sources (October), evaluation (November), and retreat/conference (December).

# SUMMARY REPORT:
# MEMPHIS URBAN MATHEMATICS COLLABORATIVE

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Memphis Urban Mathematics Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: reports prepared by the project's on-site observer; proposals submitted by the Memphis Urban League; documents and interview information provided by the project staff; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

# MEMPHIS URBAN MATHEMATICS COLLABORATIVE

## A. Purpose

As stated in the funding proposal submitted to the Ford Foundation, the primary goal of the Memphis Urban Mathematics Collaborative is to promote an environment of professionalism for mathematics teachers and to assist them in broadening their professional horizons; to establish creative working relationships between mathematics teachers and other professionals in colleges and universities, and in business and industry; and to develop creative projects that will result in teachers' improved abilities to relate mathematical concepts to students from a practical perspective.

## B. Context

Approximately 650,000 residents live in the Memphis urban area. Fifty-three percent of the total population is white and 47 percent is black. One of the fastest growing urban centers in the nation, Memphis is experiencing an influx of new businesses. In October, 1987, construction began on a multi-million dollar Navy testing center that will serve as a laboratory for testing large-scale ship and submarine models. The Center is expected to provide hundreds of jobs, as well as to stimulate growth in local service industries.

The Memphis City Schools (MCS) district consists of 159 schools, including nine vocational technical centers, one adult center, and two special education schools; 15 senior high schools (grades 9-12 or 10-12); and 14 junior/senior high schools (grades 7-12). In addition to schools with standard curricula, 26 magnet schools in the district serve approximately 11,500 students. The 11 secondary magnet schools are classified into four categories: 1) international studies, 2) college preparatory, 3) health sciences and engineering and 4) creative and performing arts. Elementary magnets focus on: 1) enriched academics, 2) open education, 3) fundamentals, 4) montessori, or 5) individually guided instruction.

The MCS district is the 15th largest school district in the nation and the largest in the state of Tennessee, with an enrollment of approximately 106,000 students. Enrollment figures were down approximately 1,500 students from projections at the start of the 1989 school year. Fifty-one percent of the student population is male and 49 percent is female. Seventy-eight percent of public school students are black and 22 percent are white. This may not be completely representative of all ethnic groups, however, as the only available statistics classified students solely into these two groups. Enrollment in optional (magnet) schools has helped to reduce the percentage of students that attends private or parochial schools from almost one-third to about 22 percent.

Less than 1 percent of the student population has English as a second language. Forty-nine percent of MCS students are in government-funded lunch programs. Information was unavailable as to the percentage of families in the district who receive AFDC.

Based on statistics provided for the 1987-88 school year, 586 students are enrolled in the only MCS middle school (grades 5-8), and 26,610 students attend 23 MCS junior highs. Approximately 51 percent of these students are male and 49 percent are female. Seventy-nine percent of the middle/junior high school student population is black and 21 percent is white. Forty-six percent participate in federally funded lunch programs.

Approximately 22,000 students attended the city's 15 senior high schools and 14 junior/senior high schools during the 1987-88 school year. Fifty-two percent of the high school student population is female and 48 percent is male. Approximately 77 percent of the students are black and 23 percent are white. Sixteen percent are eligible for federally funded lunch programs. The cumulative dropout rate for Memphis is estimated at approximately 25 percent over four years. Thirteen percent of MCS high school students dropped out during the 1987-88 school year. The dropout rate is computed by subtracting the total number of students enrolled at the end of the year from the total number enrolled at the beginning of the year; excluding any transfer students.

Approximately 16,000 students enroll in mathematics courses each year. Requirements for graduation include two units of mathematics from among the following: Arithmetic, Algebra I, Algebra II, Geometry, Pre-Algebra, and Applied Mathematics. A new ruling by the Tennessee College Board of Regents requires three years of mathematics: Algebra I, Geometry and Algebra II. As a result, enrollment in geometry and advanced mathematics has increased 103 percent, and second year algebra enrollment has increased 69 percent since 1987-88.

Test scores on the Stanford Achievement Test indicate that approximately 37 percent of MCS seventh grade students scored at or above the 50th percentile, based on national norms, in April, 1988.

The MCS district employed 2,402 high school teachers in 1987-88. Approximately 63 percent are female and 37 percent are male. The number of black teachers is approximately equal to the number of white teachers. Statewide, however, only 11 percent of the state's K-12 teacher population is black, in comparison to 22 percent of the student population. Minority college graduates are opting for higher-paying careers in lieu of teaching. The current state budget includes $250,000 in matching funds to increase the number of minority teachers.

Tennessee ranks 39th in the nation in teacher pay, with an average salary of $23,800 for a ten-month contract. The average salary for high school teachers in the MCS ranges from $18,000 per year for instructors with a BS degree and no prior teaching experience, to $36,000 for instructors with a Ph.D. and 25 years of experience. In spring, 1989, teachers asked the state for an across-the-board salary increase of $1,575 for the 1989-90 school year. Even though this was the second year the request had been made, only $1,000 per teacher was approved. As a result of financial pressures, many teachers take second jobs. While an additional $7,000 per year can be gained through the Tennessee teacher Career Ladder Program, 266 hours of extra work on approved projects earns teachers only $4,000.

The Career Ladder Program involves three experience/salary levels. Teachers' performance on examinations and classroom evaluations of their teaching are the evaluative measures the district uses in determining whether a teacher will progress to a higher pay level. Level 1 teachers are required to have at least four years teaching experience and to pass the National Teachers' Examination. In return, Level 1 teachers receive a $1,000 bonus per ten-month contract. Level 1 teachers with nine years of experience can obtain Level 2 status by being evaluated by three state-designated evaluators, the principal, a district mathematics supervisor and one class of students selected by the teacher. Level 2 teachers receive a bonus of $2,000 per year for a ten-month contract, and can receive an additional $2,000 if they work an additional month. Level 2 teachers with 13 years of experience can reach Level 3 by submitting to further evaluation procedures. In return, Level 3 teachers receive a bonus of $3,000 for a ten-month contract, and can earn an additional $2,000 for an 11-month contract or $4,000 for a 12-month contract.

Many teachers are unhappy with the state's Career Ladder Program, as they feel that the program does not really reward excellence in teaching but requires individuals to work an extra two months for the extra $4,000. In addition, only 25 percent of all eligible teachers have attained the highest levels in the program.

All MCS teachers receive five in-service days and five administrative days per year for professional development. Approximately 60 percent of MCS high school teachers are members of a local teachers' union.

MCS schools employ 350 mathematics teachers. Sixty-four percent are female and 36 percent are male. Approximately 52 percent are black and 48 percent are white. Fifty-two percent of high school mathematics instructors have earned at least a Master's degree, and 79 percent have earned at least a Bachelor's degree. Of the total, 314 high school teachers are certified to teach mathematics, but not all mathematics-certified instructors actually teach mathematics courses. Only about 90 percent of those currently teaching mathematics are certified to do so. Eighty-one percent of certified mathematics teachers are tenured.

Dr. W. W. Herenton has been the superintendent of the MCS system for ten years. He is the city's first black superintendent of schools.

Memphis Public Schools, ranked 15th in size, was 36th in terms of spending among the country's 44 largest school systems in 1988. The total budget proposed for the 1988-89 school year was $327 million, an increase of 11 percent over the 1987-88 school year. Approximately 51 percent of total revenues for the MCS system comes from local sources, 45 percent comes from state monies, 2 percent comes from federal sources, and 2 percent comes from outside revenues. A four-cent tax shift added about $1.75 million to the city and county schools coffers for the 1988-89 school year. An additional 31-cent property tax increase for 1989 was rejected by the City Council, leaving the school system approximately $10 million in debt.

Due to the lower-than-projected enrollment in the city's secondary schools, about 30 teachers were laid off in September, 1988. Mathematics teachers were not affected by this layoff.

In the spring of 1988, Memphis real estate developer Avron Fogelman proposed a multimillion-dollar scholarship program to allow low income students to attend Memphis

State University. To qualify for the scholarship, students must maintain a 2.75 grade point average in grades 9-12, perform community service projects, and stay clear of drugs and illegal activities. Recipients must also come from homes with an income of $15,000 per year or less. Further, applicants must show that they could not get another scholarship or other financial aid. Mr. Fogelman will pay the difference between scholarships and tuition costs for those students who can get other scholarship money, but will not pay for full tuition. In the first year of its existence, more than 6,000 seventh graders signed contracts to become eligible for the aid.

One of the major concerns facing the MCS district is the poor physical condition of many of its older buildings. Proposals include demolition of schools with the most severe problems rather than renovation. The proposed closing of six schools will save the district an estimated $10 million.

Despite the complex problems facing the MCS system, teachers continue to strive to provide their students with a quality education. Since 1982, five district schools have been cited by the U.S. Department of Education for excellence in education.

### C. Development of the Collaborative

The Memphis Urban League continued as the collaborative's funding agent, with Herman Ewing, Chief Executive Officer of the League, as collaborative director. Mr. Ewing is responsible for coordinating the project's efforts with the Ford Foundation, the larger UMC community, the Memphis Board of Education, and consultants to MUMC. The MUMC budget must be approved by the Memphis Urban League Board. Projects involving the school system are operated through the MCS Division of Optional Schools and Ford Foundation Projects. Nancy Gates, a Memphis mathematics teacher, devotes 60 percent of her time to the role of collaborative coordinator. Ms. Gates is responsible for implementing program objectives as specified by the Advisory Committee; coordinating the activities of the various committees; supervising the collaborative staff; and serving as a liaison among the collaborative, the Memphis City Schools, and the Memphis Urban League. She also serves on the UMC Standing Committee that met for the first time in May, 1989.

Ms. Fatima Durham served as Ms. Gates' administrative assistant from the fall of 1987 through October, 1988, when she relocated outside the Memphis area. At that time, the position was increased from 80 percent to full time and was redefined to integrate the responsibilities of the project assistant with those of an outreach consultant. On November 1, 1988, Anne White assumed the new position of Associate Coordinator. Ms. White holds a bachelor's degree in statistics from Memphis State University and is experienced in business management. She is a former student of Ms. Gates, who contributed to Ms. White's interest in mathematics. Ms. White is responsible for office operations, the Teacher Internship Program, the Speakers Bureau, the collaborative newsletter, and the development of outside funding sources. In December, 1988, Donna Porter, a full-time mathematics teacher at Westwood High School, was appointed as the collaborative's workshop coordinator. She received a small stipend for performing duties that included planning and coordinating the Mathematics in Applications Workshop in June, 1989; meeting monthly with the project coordinator; and soliciting teacher comments and suggestions.

In September, 1988, the project coordinator and project assistant relocated from the Memphis Urban League office to White Station High School, where space is provided from the optional schools budget. This move enabled Ms. Gates to teach two morning classes and then perform her duties as coordinator during the remainder of the day. The district's acquiescence with Ms. Gates' dual role conflicts with its refusal to hire part-time teachers. The Memphis Urban League continues to administer the fiscal and personnel operations for the collaborative. The collaborative director and project coordinator scheduled weekly meetings during the year to maintain communications between the two offices.

The Memphis Urban Mathematics Collaborative receives financial support from the Memphis City Schools; five universities and community colleges; and approximately 22 local corporations, businesses, and public agencies. Seven additional businesses provide indirect support that may include the contribution of individuals' time and expertise, but not funding.

All of the approximately 350 Memphis City School secondary mathematics teachers from the 53 schools with students in grades 7-12 are eligible to become members of the Memphis Urban Mathematics Collaborative. To become a member, a teacher simply needs to complete a form at the beginning of the school year indicating a desire to belong. In the 1988-89 school year, 275 secondary mathematics teachers joined the collaborative, a significant increase over the 205 teachers who had registered for the 1987-88 school year. Approximately 150 collaborative teachers participated in at least one of the project's activities during 1988-89 and 35 were very active throughout the year. The collaborative also invites private, parochial, and county schools to attend select collaborative activities, conferences and dinner symposia. The district grants two more staff development days each semester to collaborative teachers than it does to the rest of the faculty in the district. The 275 teachers who registered to join, in combination with the 50 resource people and the 20 speakers from higher education and business who agreed to participate, comprised the collaborative membership during 1988-89.

Three central committees and several smaller subcommittees that have been established to address special issues directed the operations of the Memphis Urban Mathematics Collaborative during the 1988-89 school year. In the spring of 1989, a think-tank group began work on the plan for permanence that was submitted to the Ford Foundation in June, 1989. In addition to providing direction and resolving issues for the collaborative, the committees act as a structure in which teachers can interact with their colleagues and with representatives from other sectors.

### Executive Committee

The Executive Committee, which consists of the collaborative director and coordinator and key individuals from the Memphis City Schools and from the Memphis Urban League, meets monthly in the deputy superintendent's office. Specifically, the group includes Deputy Superintendent Johnnie B. Watson; Herman Ewing; Nancy Gates; Advisory Committee Chairperson Marshall Jones; and the Director of the Division of Optional Schools and Ford Foundation Projects, Linda Sklar. This committee began meeting monthly during the 1987-88 school year to ensure that communication is maintained among the various groups and that the collaborative programs reflect the priorities and needs of the district. During the 1988-89 school year, meetings were held on an as-needed basis, and in particular when organizational issues required action. Issues that were addressed by the committee during the year included hiring the associate coordinator; permanence; communication; coordination among the Memphis City Schools, the collaborative and the Memphis Urban League; and the need for and cultivation of MCS support on specific issues.

## Advisory Committee

The 23-member Advisory Committee is scheduled to meet quarterly and continues to develop program objectives, to provide input from business and higher education, and to set collaborative policies. The membership of the Advisory Committee was increased from 20 members in 1987-88 and includes the three collaborative administrators, the workshop coordinator, seven teachers, six from higher education, four from business or civic organizations, and two administrators from Memphis City Schools.

The Advisory Committee met in regularly scheduled meetings twice in 1988-89, on October 4, 1988 and on January 10, 1989. The committee also met on January 26, 1989, in a special session to approve the budget. Twelve members attended each of the two regularly scheduled meetings. Although Professor Marshall Jones had resigned as chairperson for the committee at the May, 1988 meeting, he reconvened the committee at its October meeting because a new chairperson had not yet been appointed by the collaborative director. A key issue was whether to appoint someone from the world of business who had not been a member of the committee or someone from among the committee membership. At the October meeting, the committee received the report from the Permanence Committee, which had met once in June and discussed at length where the collaborative should be located. The committee also reviewed a statement, prepared by the Teacher Committee, which was to be given to the district, listing what is needed to implement the NCTM Standards. The Advisory Committee expressed concern that the teachers' statement was too strongly worded, and several committee members volunteered to help the authors revise it. Other items discussed included a report that Dr. Herenton was impressed by the number of teachers who have joined the collaborative, the preparations for the Mathematics in Applications Workshop, a summary of projects held during 1987-88, and the collaboratives' relation to major goals set by MCS.

The major points discussed at the January 10, 1989, Advisory Committee meeting were revising the budget to accommodate the two new positions of Associate Coordinator and Workshop Coordinator and reviewing the replacement of non-Advanced Placement calculus with an Introduction to College Mathematics course. A listing of future collaborative activities also was presented. On January 26, the committee met again and approved unanimously the revised budget and position descriptions for the two positions.

## Teacher Committee

The Teacher Committee is responsible for proposing recommendations to the Advisory Committee and for encouraging teachers' participation in the collaborative. The membership of the committee, which was increased from 12 teachers to 14 teachers in December 1988, also includes the collaborative coordinators. The committee met three times during the year, in September, December, and March.

Eleven members attended the September 26, 1988 meeting to discuss the direction and future projects for MUMC. The teachers felt very strongly about the workshops and projects they wanted held during the year. The group also discussed a working draft of a statement, prepared by three of its members, regarding what MCS needed to do to implement the NCTM Standards. The statement was prepared to follow up on the list of needs teachers had generated at an August in-service on the Standards that featured a presentation by Dr. Tom Romberg, University of Wisconsin-Madison. His speech was entitled, "Overview of the NCTM Standards for School Mathematics." After the committee meeting, teachers commented that they looked forward to the meetings and felt that they provide input into setting the collaborative's agenda and priorities. In addition to the NCTM Standards Committee, three teachers were appointed to an ad hoc committee to plan the Math Reform and Teacher Professionalism Symposium and the Math in Application summer workshop, both of which will be conducted by teachers. The committee also decided to send a needs assessment survey to MUMC teachers requesting suggestions for topics that would be priorities for a summer Woodrow Wilson Institute Workshop.

Ten members of the Teacher Committee attended the December 5 meeting. Committee Chair Susan Wyant, who was appointed by Project Coordinator Nancy Gates, conducted the meeting. The committee voted to appoint four teachers to replace two members who had left the district, which brought its membership to 16. The committee reports were approved and new projects were discussed. A sub-committee of three teachers was established to develop the curriculum review workshop. It was also announced that the University of Illinois at Urbana-Champaign was to sponsor a three-week summer institute, and that a team of five teachers could apply. The committee was informed that two teachers will be selected to attend the UMC Leadership Conference to be held August in Boston, and the possibility of applying for a grant from Apple Computers was discussed. The revised statement to MCS on what was needed to implement the NCTM Standards was given to the committee. This statement was given to the assistant superintendent to present to the administrative staff for approval, but no action has been taken.

Eleven members, including three of the newly appointed teachers, attended a Teacher Committee meeting on March 9. The collaborative's permanence plan was the major topic of discussion. Teachers stressed that the collaborative should continue to sponsor workshops, travel time, professional leave, and internships, and should enhance and expand its relationships with business. Finally, the committee devised a system by which principals could recommend teachers to attend the Curriculum Review Workshop. The on-site observer reported that a good exchange of ideas took place.

## Planning for Permanence

Permanence had been the topic of informal discussion by the collaborative administration and the Advisory Board throughout the 1987-88 school year. A subcommittee, appointed by the Advisory Board at its May, 1988 meeting, met once on June 25, 1988 to formulate some ideas on the permanence process that could be brought back to the Advisory Board. The report of the permanence subcommittee at the October, 1988 Advisory Board meeting generated questions and discussion. On February 13 MCS Deputy Superintendent Johnnie B. Watson, the collaborative administrators, and a few members of the Advisory Committee met with Mark Driscoll from EDC. Out of this meeting came the decision to form a think tank to develop the permanence plan.

The 24-member group met for six hours on March 11 at Rhodes College. The group was composed of the three collaborative administrators, 14 teachers (including a kindergarten teacher who was appointed in anticipation that the collaborative would eventually encompass elementary teachers), four representatives from higher education, and one from business. In addition, Mark Driscoll attended the first meeting. At this meeting, led by Herman Ewing, the group brainstormed ideas for permanence. Discussion covered the accomplishments of the MUMC, the activities that should be continued, and the goals of the collaborative. The Think Tank Committee developed an impact list of MUMC, which included enhanced communication among teachers, and between teachers and those in higher education; motivation to try new techniques and ideas, and a greater sense of professionalism among teachers. Needs that were identified centered around increasing the interaction among teachers, principals and supervisors, and the Memphis State University mathematics department. The group produced a draft of a goal statement, a list of assumptions, and a description of how various supporting groups (e.g. school administration and teachers, higher education, business, and parents) could provide assistance to the collaborative.

Thirteen members of the Think Tank attended its second meeting held April 10. At the meeting, members redefined the goal statement, discussed the need for a host agency to administrate funds, and created an organizational structure that included a governance board, teacher committee, executive committee and staff. Discussion of these and other topics continued at the May 4 meeting, which was attended by 14 members and Mark Driscoll of EDC. Topics of discussion included potential host agencies, membership of the governing board, and the decision-making process. A key issue was the relationship of the Memphis Urban League to the collaborative and the relinquishing of the League's control over collaborative finances. At the May 16 meeting, held at the offices of the Board of Education and attended by 19 members, a draft of the proposal prepared by Ms. Nancy Gates was reviewed and approved. The group also agreed to transfer some budgetary control in 1990 from the Urban League to the collaborative. Voting procedures and the composition of the governing board were discussed extensively.

On May 31, 1989, the MUMC permanence proposal was submitted to the Ford Foundation. The proposal requested two years of funding over a period of transition that would lead to a non-profit, self-supporting organization governed by a board and financed through grants, contributions, and MCS support. During this two-year transition period, the collaborative would operate with the current administrative structure supported by a Governing Committee that would evolve into the permanent governing board, an Operating Committee, and an Executive Committee. Membership on the Governing Committee would be identified by the Think Tank group in terms of one, two, or three years, to be determined by drawing lots. The Operating Committee will consist of ten teachers appointed by the Governing Committee. The Executive Committee will remain as is. The Memphis Urban League Board will relinquish control of the collaborative to the Governing Committee according to guidelines defined by the MUL Board. Beginning in January, 1990, upon receipt and approval of a request for funds from the Governing Committee, the Urban League Board will release funds for three months to the committee. Over time, the collaborative plans to expand its membership to include elementary teachers. Current activities will be continued, and stipends for workshops and professional meetings will be offered as funds are available.

An addendum to the proposal was submitted on June 30, 1989 in response to questions raised by Dr. Barbara Scott Nelson of the Ford Foundation. The addendum clarified some specific points on governance and the three-year budget and responded to three specific issues. First, after the MCS program to "deregulate" some schools has been in effect for one year, the MUMC will offer to help these schools to develop their mathematics programs. This curricular shift will exert heavy demands on the teachers at these schools; it is believed that these departments will need time to get organized before MUMC recruits these teachers for committees and other activities. Second, the Governing Committee will continue to ensure that no fewer than 40 percent of the teachers participating in each of the phases of the collaborative will be from any one racial group, black or white. And third, over the three-year transition period, the Governing Committee will explore and consider various alternatives for host agencies, including colleges, universities, businesses, public non-profit organizations, and the Memphis City Schools.

## D. Project Activities

During 1988-89, the Memphis Urban Mathematics Collaborative sponsored a variety of activities to promote teacher professionalism, to establish linkages between Memphis mathematics teachers and other mathematics professionals in business and higher education, and to enable teachers to keep abreast of developments in the fields of mathematics and teaching. The collaborative also supported teachers' attendance at national and regional meetings and workshops.

### Local Workshops

#### NCSSM Mathematics and Computer Workshop

The collaborative, with support from the North Carolina School of Science and Mathematics (NCSSM), sponsored a one-week workshop to provide teachers of fourth-year high school mathematics courses with training in the newest techniques and applications for pre-calculus instruction. The workshop was conducted by two MUMC teachers, both of whom had received collaborative funding to attend a curriculum workshop at NCSSM during the summer of 1987. The agenda for the workshop, which was held July 11-15 at the East High computer lab, included discussions and demonstrations on four topics: Functions, Geometric Probability, Data Analysis, and Matrices.

All 13 participants found the workshop very worthwhile, although many suggested that it was more useful for senior high mathematics teachers than for junior high teachers. On the written evaluation forms, all of the participants rated the workshop a 4 or 5 (on a 5-point scale) for clarity of goals, effectiveness in fostering learning, helping to learn, helpfulness of the instructors, and likelihood they would recommend the workshop to other teachers. The on-site observer reported, "The teachers were quite complimentary about the two instructors. On all the evaluations, the workshop was rated in the upper range: 4 or 5. The instructors were also pleased with the participation and interest exhibited by all the teachers."

## Geometric Supposer Workshop

On July 16, the collaborative presented a Geometric Supposer workshop at the East High computer lab. Ms. Phyllis Stickney, a high school mathematics teacher from the Philadelphia collaborative, demonstrated the software program. Twenty-one MUMC and private school teachers attended.

The participants complimented the instructor and rated the workshop very positively, with all but two participants rating it 4 or 5 on a 5-point scale. One teacher wrote, "This workshop gave teachers hands-on experience. Thanks MUMC, and keep the work up." Another added, "Geometric Supposer should be provided by the Memphis City School System." The on-site observer reported, "The evaluations show that the participants felt the workshop was good and helpful. Comments were favorable except for the length of the workshop; many would have preferred a two-day session."

## BC Calculus Workshop

During the last week of summer vacation, August 15-19, 18 collaborative teachers participated in a 16-hour collaborative-sponsored workshop, "Topics Taught in BC Calculus." The workshop, which was held at Christian Brothers College, was taught by Drs. Larry Gulde and Leigh Becker. It focused largely on differential equations, and series and sequences.

As compensation for their attendance, the collaborative offered each participant a choice of receiving either a Hewlett Packard 28 S graphing and programmable calculator, or a $200 stipend. Suggestions for using the calculator were included in workshop content.

Most of the participants rated the workshop 4 or 5 on a 5-point scale and were most appreciative of the materials and information they received. A few of the teachers who did not have the prerequisite knowledge of integral and differential calculus found some of the content "too involved." Several teachers requested additional time in which to incorporate more content and teaching strategies for use in Advanced Calculus.

## Mathematics for the 1990's

On March 3, MUMC sponsored a one-day workshop, "Mathematics for the 1990's." The workshop, which had been planned by a teacher subcommittee, was designed to introduce participants to new trends in mathematics and methods for teaching probability, geometry, applied mathematics, and advanced mathematics. The keynote speaker was Dr. Bill Leonard of California State University. Dr. Leonard taught high school and college mathematics for 30 years and also worked as a research engineer and applied scientist. Dr. Leonard's morning plenary session, "Learning to Expect Unanticipated Results," focused on several results in probability that would typically not be expected.

Following a lunch break, the teachers had the opportunity to attend one of three sessions: "Implementing the Standards in College Preparatory Mathematics"; "Discovering Geometry"; and "Mathematics in Applications." Each session introduced teachers to technology and new approaches that could be used in the classroom.

Sixty teachers attended the workshop, including 48 MUMC teachers, six private school teachers, and six representatives from higher education. It was held at State Technical Institute. Collaborative teachers were permitted to use one of the four professional leave days granted them by the Memphis City Schools.

Evaluations of the workshop were very favorable. Most of the teachers rated the workshop 4 or 5 on a 5-point scale and expressed the desire for "more workshops of this type." A few teachers commented on the lack of computer accessibility. The on-site observer reported, "Teachers I talked to were most positive and said the day was well worthwhile. Most wanted more time!"

On the evening of March 2, the night before the workshop, the collaborative hosted a dinner at a local restaurant for the four workshop leaders and selected collaborative teachers and administrators. The evening provided a warm welcome to the speakers as well as the opportunity for an informal exchange of ideas among the guest speakers and selected MUMC teachers.

## Mathematics Made Meaningful

On April 25 and 27, Patti Scanlon, a kindergarten teacher at Idlewild Elementary School, held an open house in her classroom to show other teachers how she introduces mathematics to her students. Ms. Scanlon uses the Mathematics Made Meaningful program, which is a holistic approach to critical thinking skills in mathematics. The program stresses estimation, pattern recognition, data analysis and locating mathematics in everyday life.

The teachers who attended the after-school open house heard a brief introduction and then had the opportunity to visit the various "learning sites" Ms. Scanlon has set up in her classroom. The response to the open house was much greater than anticipated, with a total of 78 teachers taking advantage of the opportunity to visit the classroom. The on-site observer reported that the teachers "were open to this new, holistic approach to teaching math and critical skills and really got into the setting and were very active in checking out Patti's learning centers."

## Curriculum Review Workshop

On May 15 and 16, the collaborative sponsored a workshop to provide teachers an opportunity to review the present curriculum and make recommendations for change. The workshop was planned by a subcommittee of the Teachers' Committee, in response to teachers' concerns about the critical need to implement the NCTM Standards. Sixty-nine junior and senior high school mathematics teachers participated in the workshop, which was held at State Technical Institute. Participants were nominated by their principals. The session leaders, who received a $50 stipend for participating, submitted a list of the teachers' recommendations to the curriculum coordinator. Recommendations focused on instructional topics, sequencing of topics, and time frames. Summaries were made available to all MUMC members.

The participants evaluated the workshop as very worthwhile, with most rating it 4 or 5 on a 5-point scale. The most frequent comments related to ensuring that the recommendations were disseminated to all teachers and to the lack of an MCS authority present at the workshop who could comment on the feasibility of implementing the recommendations.

### Mathematics In Applications

Between June 26-30, the collaborative sponsored a summer workshop entitled "Mathematics in Applications" to showcase practical application problems for a variety of topics, including ratios, diagramming, computer literacy, estimation, and statistics. The International Paper Foundation contributed $1,000 to help fund the workshop.

Topics for the workshop had been selected by a committee of teachers that met throughout the 1988-89 school year to plan the event. In December, the teachers who served on the planning committee made site visits to four area businesses to identify how mathematics is used in daily operations at each site. In January, the committee met to discuss what had been learned at the site visits, to suggest topics for the summer workshop, and to formulate teacher teams to make the presentations. In April, workshop leaders met to finalize the details for the workshop and to organize the remaining tasks.

The workshop was partitioned into two targeted groups because of the wide range of mathematical skills identified: teachers of grades 7-9 and teachers of grades 10-12. Topics for teachers of grades 7-9 were addressed on Monday and Tuesday, while topics for teachers of grades 10-12 were addressed on Wednesday and Thursday. On Friday, all participants met together.

Each workshop day began with a presentation by a business consultant on mathematical concepts used in the workplace. Next, a teacher team introduced methods for developing practical application problems to supplement the existing curriculum. In the afternoon, teachers worked in groups to create application problems based on the topics that had been addressed.

All collaborative teachers were invited to attend the workshop, which was held at the State Technical Institute. The 38 participants each received a $40 per day stipend. SACS credit was also available.

On the written evaluations, the majority of the participants rated the workshop high in terms of interest, usefulness and organization. Many commented that they really enjoyed hearing speakers from the worlds of business and industry. One teacher, for example, wrote, "I liked the business alliance with our efforts in teaching mathematics." Another commented, "Good to have speakers from industry as St. Jude and Diesel Recon." The teachers expressed interest in hearing "more sharing of ideas among teachers and more outside people from business with suggestions on how to prepare our students to take jobs." The on-site observer reported, "The majority of evaluations were positive and rewarding. This was the first workshop planned and directed by teachers themselves. The business professionals were a big hit for most teachers."

## Conferences and Institutes

### LOGO Institute Conference

The collaborative sponsored two teachers' attendance at a two-day LOGO conference at Lesley College in Cambridge, Massachusetts, on August 20-21, 1988. The conference was designed to inform teachers who use LOGO and other similar programs about the latest trends. Workshops discussed teacher preparation at the college level and presented information on how to incorporate LOGO and Logowriter into various curriculum areas, including social studies, mathematics, and English. Conference highlights included presentations on LEGO/LOGO and on Gary Stager's student-created animated time line of the Revolutionary War.

Both teachers reported that the conference was enjoyable and beneficial. One teacher commented, "The conference was very interesting. It was exciting to see and hear ideas from people who were actually using LOGO and Logowriter in their classes. The possibilities were unlimited. I wish we had more time there. It was great to see the spirit of those who attended previous conferences. It was like a big family reunion with the LOGO community. Because we were there only two days (not the two-week course), I felt we couldn't get into the spirit in depth." The other teacher commented, "I thought it was worthwhile. I enjoyed it and even learned some things. It was a good experience."

## NCSSM Follow-Up Session

Two of the three collaborative teachers who had participated in a pre-calculus workshop sponsored by the Carnegie Corporation at the North Carolina School of Science and Mathematics (NCSSM) in the summer of 1987 attended a follow-up session at NCSSM in February, 1989. The follow-up session, led by Joan Countryman, covered the introduction of writing into the mathematics curriculum, and provided participants an opportunity to share information with NCSSM faculty. Both teachers felt that the workshop was very worthwhile. One of the teachers, Virgie Cox, had presented a workshop "Mathematics and Computers" for MUMC teachers in July, 1988. The other teacher, Lana Solomon, is scheduled to speak at the NCTM annual conference in April, 1989.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Twelve Memphis teachers and the collaborative's coordinator and associate coordinator received funding to attend the annual meeting of NCTM in Orlando, Florida, April 12-16. The theme of the conference was "Vision for the World of School Mathematics." During the day, the teachers attended sessions concerning such topics as estimation, graphing techniques, math anxiety and computers in mathematics. In the evening, the teachers attended sessions with members of the other ten collaboratives from across the country. The evening sessions, sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and the Australian Mathematics Curriculum and Teaching Program.

The collaborative reimbursed 12 of the 14 participants for airfare, hotel, and registration fees. The UMC Technical Assistance Project paid the expenses of one teacher, and the UMC Documentation Project supported the attendance of the on-site observer. The Memphis Public Schools provided release time for all attendees to go to the conference. The ten teachers (representing nine schools) who received collaborative funding to attend the conference were selected from a group of 14 applicants by a subcommittee of the Advisory Council. The on-site observer reported that the committee was surprised by the low number of applications. The committee selected the ten teachers to attend the conference based on the following criteria: 1) whether or not the teacher fulfilled in-service and leadership duties after attending the previous conference, and 2) whether the sessions being offered at the conference were appropriate for the grade level taught by the teacher. In return for the financial support, the teachers were expected to share their experiences and new knowledge with other Memphis teachers at MUMC workshops and in-services.

On February 24, the teachers who had been selected to attend the conference met at the home of the collaborative coordinator to work out logistics. The teachers discussed which workshops they would attend, selected roommates, and finalized transportation plans. The on-site observer reported, "The teachers were happy and excited about their selection. Veterans gave tips about what to see/do at the displays and UMC meetings."

After the conference, all the teachers reported that they brought back at least one new idea or approach that they wanted to try in their classroom. Most felt that the sharing with others was the most rewarding aspect of the conference.

On the evaluation forms distributed by the collaborative, one teacher wrote, "It was a great experience! I really hope word gets out and more teachers will take advantage of the opportunity to come. These conferences refresh teachers and give them incentive to go home and keep working hard or try something new. They update teachers on what is going on in mathematics." Another wrote, "The NCTM meeting has been everything I expected and a lot more. I feel like I've learned so much and gained so many new ideas."

## Woodrow Wilson Summer Institute

On June 19-23, 1989, the Memphis Urban Mathematics Collaborative, in collaboration with the UMC Technical Assistance Project at EDC (which contributed $2,500), sponsored the Woodrow Wilson Institute Workshop at Rhodes College. The Institute, the second that the collaborative has brought to Memphis, is part of the Woodrow Wilson Fellowship Foundation's "Teachers Teaching Teachers" program in which some of the best mathematics teachers from across the country are trained at Princeton to conduct Institutes at selected sites. Led by Joan Countryman, Jo Ann Lutz, Lew Romagnano, and Tom Seidenberg, the Institute was targeted at teachers of Algebra II, Advanced Mathematics, and Calculus, and focused on the use of technology to teach traditional topics in new and exciting ways. A strong emphasis was placed on exploring and working with new software programs, as well as the usefulness of graphing calculators. Throughout the five-day workshop, the philosophy of mathematics as "a way of thinking" as opposed to a body of facts and techniques, was stressed. The event was open to all teachers of

Algebra II and beyond in the Mid-South area, which includes Tennessee, Arkansas and Mississippi. Twenty-seven teachers participated, including 11 collaborative teachers, the collaborative coordinator and 15 non-collaborative teachers. The collaborative, with support from Memphis City Schools, paid the tuition of its members, and all teachers received SACS credit for their attendance.

Twenty-three of the 25 participants who filled out evaluation forms rated the workshop 4 or 5 on a 5-point scale in terms of usefulness, clarity and helpfulness of instructors. One teacher commented, "I really enjoyed the workshop. Thanks, Nancy [Gates], for inviting us to attend. We appreciate your including us private school teachers." Another wrote, "Until I attended this workshop, I felt our school was doing a good job. I feel we need to have computers and technology now. We must change our methods--for our students' sakes." Many teachers wrote that they would have liked to have had more lab time to work with the computers. And one said, "I don't feel ready or prepared to include what I've seen in my classes this fall. I attended the Geometry workshop [last summer] and felt excited about what I learned. I left that workshop knowing how I'd change my classes in the fall. These instructors are good, but lack the dynamism of last year's team."

The on-site observer reported, "The best comment to describe this [workshop] was heard at our last session: 'Can we have another Woodrow Wilson Institute next summer?'. Leaders were personable and patient. Lab time gave us an opportunity to try good software and to work with other teachers. Many concepts and techniques were demonstrated! Good, intense week!!"

## Phillips Exeter Conference on Computers and Mathematics

The Memphis Urban Mathematics Collaborative sponsored four teachers' attendance at the Phillips Exeter Conference on Computers and Mathematics, June 26-30, 1989, at Phillips Exeter Academy. MUMC teachers were given the opportunity to apply for the four travel awards, which included complete travel, registration, room and board expenses. Applications for the awards were distributed at the "Mathematics for the 1990's Conference." Principals at schools that had computers also recommended teachers.

Participants attended the conference with the expectation that they would gain new ideas for computer applications in their classrooms. In return for funding, they are expected to offer an in-service session to share their knowledge with other collaborative members. The teachers' comments about the workshop were very favorable. The first teacher remarked, "I think it's fantastic! It's math from morning until night. I'm going back regardless if the MUMC pays it. I plan to return if I must pay it myself. The facilities are great; the speakers were excellent! I learned so much! I thoroughly enjoyed it! I loved meeting people from around the country . . . definitely worthwhile." A second teacher added: "I'd like to go next year! There were a lot of offerings--it was hard to choose. I got great software packages--I want to share with people. Food was really good. It was nice to have a car available. The demonstrations were top-notch!" The on-site observer reported: "The attendees were very excited about their week at Exeter. They are ready to return next year! I didn't hear any negative comments. The program was challenging as well as fun."

## Teacher Leadership Training Conference

In August, 1989, the Educational Development Center in Boston will sponsor a Teacher Leadership Training Conference for UMC teachers. Each collaborative was invited to send three teachers to the conference, which is designed to provide UMC teachers with training in communication, negotiation and meeting skills. In addition, the conference is expected to provide teachers an opportunity to think about their vision for the teaching profession and educational system as a whole. The collaborative selected four teachers to attend the conference, one as a moderator. MUMC will pay for one of the participants and EDC will pay for the other three.

In preparation for the conference, MUMC held a meeting on June 8 at which the collaborative coordinator, the assistant coordinator, the on-site observer and four of the five teachers who will participate in the Leadership Conference met for lunch at the MUMC office. At this meeting, participants decided to survey 100 MCS mathematics teachers on the issue of equity to obtain representative responses to take to the Boston meeting. They planned to design the survey to include questions relating to the definition of equity, the way in which the MCS is addressing the issue, the way each individual teacher addresses it, and the obstacles involved. The teachers compiled questions for the survey, decided upon a selection process to determine which teachers would be surveyed, and planned who would organize the letter and mailing. The on-site observer reported that the group worked cooperatively, quickly and efficiently.

### Conference and Institute Travel Grants

Eighteen MUMC teachers have received travel grants for the summer of 1989. The grants will be used to sponsor teachers' attendance at the Phillips Exeter Conference (four teachers); Teaching Leadership Training Institute (four teachers, including three supported by EDC); Ohio State University Calculator and Computer PreCalculus Project (one teacher); Advanced Placement Calculus Course (two teachers); Discrete Mathematics Conference (MUMC promoted the DMC and helped the four teachers who received funding to prepare their applications); Mathematics Their Way (two teachers); and Illinois Institute for Statistics Education (two teachers and the assistant coordinator; the assistant coordinator had organized a team application for this meeting). In addition, the collaborative coordinator will attend an Advanced Placement Workshop in Tuscaloosa, Alabama, and the assistant coordinator will be a district team coordinator for the Illinois Institute for Statistics Education Program.

## Dinner Meetings

### Mathematics Reform Dinner Symposium

On August 24, 1988, the collaborative hosted a Dinner Symposium at the French Quarter Inn. Professor Tom Romberg, Professor of Curriculum and Instruction at the University of Wisconsin-Madison, Chair of the NCTM Standards Commission and Director of the UMC Documentation Project, was the guest speaker. The symposium was planned as a way to get the MUMC teachers together to kick off the school year and to inform them about the NCTM Standards. Fifty-six people attended, including the collaborative director and coordinator, and two mathematics department chairs from private schools.

The on-site observer reported that the meeting was a great success. "I personally enjoyed the meeting. I felt very fortunate to have MUMC organize such an evening. Tom was wonderfully interesting. It was a good way to share an evening before school went into full swing. . . Everyone felt Tom's speech was interesting and enjoyable. . . . Many felt very grateful about all the activities that MUMC has done or arranged for them."

One teacher commented, "I truly enjoyed the evening. The camaraderie that the collaborative has brought to us is just wonderful. I feel good about knowing most of the people there tonight--a few years ago, I did not know many." Another added, "I thought the evening was great. I enjoyed meeting so many math teachers. I thought the speaker was interesting. I'm really grateful that I was invited to this event." A third teacher remarked, "The speaker was good and had very useful information. I felt as if I were a real part of what was said. I think the dinner and small room setting helped to make us feel involved. I would like to attend more dinner meetings like that one."

## Geometric Supposer User Group Dinner Meeting

On November 9, the collaborative hosted a dinner meeting for teachers who had received the Geomtric Supposer software from the school district. The meeting was a first step toward establishing a support network that would allow user teachers to share tips and ideas with teachers who had not previously used the software. The distribution of the Geometric Supposer software increased from two teachers in 1987-88 to eight schools in 1988-89.

Twelve teachers attended the dinner, which was held at the Racquet Club. The on-site observer reported that all the teachers who attended the dinner meeting seemed to benefit from their membership in the support group. One teacher commented, "The meeting was really worthwhile. It encouraged us to jump in and try using the software. I've already been using it but I received some insights into new things to do and how often I should use it in class. The meeting was informal and great for sharing. Three or four of us are using the software but scheduling computer time in individual schools seems to be a problem." Another added, "The meeting gave us a chance to see what others are doing. We shared worksheets by those who are using the Supposer already. We discussed how to use and improve on the worksheets. Everyone left enthusiastic and ready to get started. Access to computers is the number one problem. We need another meeting second semester."

## Colloquium and Reception

On January 19, 1989, MUMC sponsored a colloquium and reception at Rhodes College, featuring Dr. Mary Treanor of the Department of Mathematics and Computer

Science, Valparaiso University. The seminar was targeted primarily at teachers of Algebra II through Calculus, but all interested mathematics teachers were invited to attend. In her lecture, "What are Some Dimensions on Mathematics Teaching?" Dr. Treanor discussed connections between inequalities, limits and proofs. The formal presentation began at 4 p.m., with a reception from 5-6 p.m. in order to provide teachers with an opportunity to meet with the visiting professor and hear her views on how inequalities should be taught to enhance students' understanding of calculus.

Twenty-three people attended, including some representatives of the university. The lower-than-anticipated enrollment was attributed to the colloquium having been scheduled in the middle of semester exams. The teachers who did attend the colloquium appear to have found it very worthwhile. One teacher commented, "I enjoyed the meeting and learned some new ideas. I plan to do that next year. I think students will learn inequalities better." Another noted, "I enjoyed it. It was a new approach for me. I'd like to try that next year when I hit inequalities." A third teacher remarked, "I thought it was great. I enjoyed being here. Thanks for inviting us private school teachers."

The on-site observer reported that it was a pleasant and enjoyable session. She said that many teachers commented that they wanted to try to use Dr. Treanor's approach of solving inequalities through graphing.

### Continuing Programs

#### Summer Internships

During the summer of 1987, MUMC successfully initiated a summer internship program to provide teachers an opportunity to work in a business environment that uses mathematics. Four teachers participated in the program in 1987, and three teachers had internships in the summer of 1988. All three teacher interns during summer 1988 worked in the biostats department at one of two local hospitals. Each participant seemed to have learned from his or her internship experience. One teacher said, "My experience at St. Jude was very worthwhile. The atmosphere was very business oriented, very professional. The job was less confining than a teaching position. You did need a math background for my job. We definitely need to offer statistics in our schools--it is so needed in our world. I did notice they have many meetings--they do communicate with other cities via computers." Another teacher said, "I was at St. Jude in their biostats department. It was enlightening! Everyone was most professional. I thought it was a good experience for any high school math teacher. I learned a lot. We all need computers--this gave me hands-on experience. You could schedule your own time for lunch, breaks, etc. You were just expected to do your job. The schedule was more flexible than that of a teacher." The third teacher intern reported, "I worked two weeks at UTCHS in the biostatistics department. The experience was very worthwhile. The work atmosphere was pleasant and relaxed. I enjoyed the experience in the 'private sector.' They are even paying some of my students to collect data. Nevertheless, I prefer teaching! They even offered me a summer job for 89."

There is a possibility that six internships will be available for the summer of 1989. Companies that have been contacted include the University of Tennessee; St. Jude Children's Hospital; Memphis Light, Gas and Water; Army Corp. of Engineers; Baptist Memorial Hospital and Sharp Manufacturing. All selections will be made by the individual businesses from the pool of teachers they choose to interview. The deadline for applications is June 9, 1989.

## Speakers Bureau

During the 1987-88 school year, the MUMC established a Speakers Bureau that offers a list of approximately 50 representatives from universities, businesses and the school system who are willing to speak to mathematics classes and teachers' groups on a variety of topics, ranging from engineering and accounting to the history of mathematics and number theory. In October, 1988, an updated Speakers Bureau Directory was distributed to all Memphis City Schools mathematics teachers. The directory contains biographical information on each speaker and lists nearly 70 presentations the speakers are willing to make.

At a brainstorming meeting of the Think Tank held in March, 1989, teachers reported that the Speakers' Bureau is being well used. The teachers have begun to take responsibility for calling the speakers directly, instead of asking the MUMC office to make the contact.

### Collaborative Newsletter

In the fall of 1987, the collaborative published the first issue of its newsletter. The MUMC Bulletin, which continues to be published biannually, is distributed to approximately 250 teachers, as well as to representatives of the business and university communities. The newsletter is an important vehicle for distributing information to collaborative teachers regarding collaborative events, conferences, activities, issues in mathematics and teaching suggestions. Ms. Anne White, the assistant coordinator, edits the newsletter.

## E. Observations

### Project Management

The director and the coordinators continued to share authority and control throughout 1988-89, but they appear to have adjusted to one another's working styles. The collaborative's relocation to offices in a high school has enabled the coordinator to teach two classes and to draw upon the school district as a support system to which she is accustomed. The Memphis Urban League's role as the host agency of the collaborative required all participants to learn to work with one another and to coordinate their efforts to achieve common goals. Although the collaborative coordinator's professional experience had occurred exclusively in the context of the school system, she was required to establish her position and decipher the organizational structure of an organization outside the school district.

The Memphis Urban Mathematics Collaborative is the only collaborative of the 11 whose host agency is primarily an advocacy organization for a specific population--minorities and the poor. The other ten host agencies--education funds, a science and mathematics center or museum, a special school, and universities--have a more direct association with public schools and education. After three years, the evolution of the Memphis Urban Mathematics Collaborative provides an interesting case study in the management structure of collaboratives. The collaborative's goals of promoting a professional environment for mathematics teachers and improving their abilities to relate mathematical concepts to students coincides with the Urban League's goal of improving the educational opportunities of blacks in Memphis. However, the creation of the collaborative required that an organization which operates community programs with the help of businesses, join forces with teachers and other educators who operate out of the public service arena to draw in people from business and higher education.

The collaborative's fiscal matters, including decisions about program funding and expenses, are controlled by the Urban League. A representative of the Urban League makes budget reports to the collaborative Advisory Group at its quarterly meeting. The Advisory Group, whose chair is appointed by the Urban League, does not have final authority over the budget, but makes recommendations that are submitted to the MUL board. This is very different from the other collaboratives, which have a governing board comprised of representatives of all groups that makes final decisions about collaborative finances. The MUMC's tiered board system has caused some problems, including delays in payment of bills and in such important decisions as the appointment of the advisory board chair after Dr. Marshall Jones resigned in May, 1988.

Over the three years since the MUMC was established, the management structure has been adjusted in order to establish an agreeable working relationship among the Urban League, the project coordinator and the collaborative's Advisory Committee. Initially, the coordinator was housed in the Urban League's office and relied on clerical help from the regular MUL staff, who supported the collaborative in addition to their other work. The vast amounts of paperwork generated by the process of establishing and administering the collaborative required that the coordinator request help from the MUL staff. To ease this situation, a was hired for 80 percent time during the project's second year to assist the collaborative coordinator. The collaborative staff evolved further in its third year, when a full-time associate coordinator was hired to assume the responsibilities of an administrative assistant and an outreach coordinator. This person, in addition to a teacher who assumed the position of workshop coordinator and the existing administrative staff, provided adequate support to meet the needs of the collaborative. The gradual development of this staff structure resulted from an ongoing recognition of the organization's needs and a growing understanding of the roles of the associate coordinator and workshop coordinator.

In addition to the emergence of a stable, effective staff structure, the collaborative has worked to open the channels of communication among those responsible for its administration. The Executive Committee meetings have been important in bridging any gaps in communication that may have occurred among representatives of the school district, the Urban League, and the collaborative, all of whom bring unique perspectives and priorities to their interactions. Relocating the coordinator's office to a school, primarily to allow the coordinator to teach two classes, has helped to connect her with other teachers and with the support system provided by the school district. Although weekly meetings between the coordinator and the director of the Urban League have fostered the exchange of information, there have been occasions in which increased communication could have prevented misunderstandings. For example, teachers were under the impression that summer internships had already been arranged and were surprised when the collaborative director called a meeting to discuss how teachers could help to solicit internship placements. In another instance, the director distributed a questionnaire to teachers to gather information regarding the permanence of the collaborative at a time when the permanence proposal was near completion. Many of the teachers felt that their input was sought too late to be of any use or impact, and that the answers to the questions had already been predetermined.

The collaborative's relationship with the Memphis Urban League has added a valuable perspective to its approach to problems and issues. The director has raised critical concerns about the issue of equity. In a statement that was shared with directors from the other collaboratives, Mr. Ewing writes, "... at what point do we as a fellowship deliberately and willfully give top, prominent priority to helping our constituent teachers to recognize these equity issues and respond effectively to them, positively challenge their present comfort levels with these and related issues, and aid and comfort them in what may be a painful process of measuring their effect on the improved results of mathematics learning for black and other minorities?" The director also brings an important perspective to the permanence process, raising important questions for the collaborative to answer, such as, "To whom will the collaborative be accountable to in its permanent state if it becomes incorporated?" and "What rights should the staff have in voting on decisions?"

The Memphis City School's continued participation in and commitment to the project also must be noted. The Deputy Superintendent's participation in regular meetings of the Executive Committee and his active participation on the Think Tank Committee are indicative of the school district's interest. The school district also demonstrated its support of the collaborative by adjusting its policy on part-time teachers to enable Ms. Gates to teach two classes while continuing to serve as the collaborative coordinator. The collaborative has kept abreast of district initiatives and in its discussion on permanence considered how it can be engaged with new district programs, such as the deregulated schools program which will go into effect during the 1989-1990 school year.

## Collaboration

New forms of collaboration, including a mathematics applications workshop and a kindergarten open house, were initiated successfully during this past year. Most significant about the mathematics applications workshop is that it was planned and presented by a group of teachers who met frequently during the school year to make all of the necessary preparations. Business people were also involved but they served more as resources than as co-planners. The workshop focused on business applications that could be used in the classroom so site visits to area businesses were a key part of the planning process; this specific purpose fostered well-focused dialogue between teachers and business people and was a clear departure from the usual site visit during which teachers typically just listen to a presentation. At the workshop, business consultants made presentations on the use of mathematics in their career fields and the teachers guided the development of activities. The process generated business-teacher interaction and teacher-teacher interaction as well as produced a set of application problems for classroom use that increased the impact of the workshop experience.

The second innovative form of collaboration occurred among teachers, administrators, university students, and a kindergarten teacher. Teachers rarely have the opportunity to visit their colleagues' classrooms, much less those of other teachers around the district. Through collaborative networking, a kindergarten teacher was identified who was teaching her students critical thinking through estimation, pattern recognition and data analyses. Seventy-eight people, including two parents, 45 MCS elementary teachers, ten private school teachers, nine MSU education majors, seven MCS supervisors and four principals, visited her classroom during two after-school open houses to learn more about her approach and to view the learning centers she had established in her classroom. This experience provided the opportunity for teachers as well as other members of the community to learn from their peers and to become more aware of new ideas that are being implemented in the elementary grades. This vertical form of collaboration is a positive step toward an articulated K-12 mathematics program.

The greatest impact of collaboration at this stage of the MUMC's development has been a marked increase in collegiality both among Memphis teachers, and between Memphis teachers and their peers across the nation. During 1988-89, teachers had opportunities to work closely together in committees, such as in planning the Mathematics Applications Workshop and "The Mathematics for the 1990's" workshop. It is clear that the collaborative has begun the task of establishing support networks and professional collegiality among the 350 middle and high school mathematics teachers in the Memphis City Schools.

The collaborative's core group, comprised of its frequent participants, still represents only about 10 percent of all teachers, indicating that there are a number of teachers who have not made the decision to become immersed in the collaborative. The large number of teachers who attended activities during the 1988-89 school year indicates that interest in the collaborative is spreading and that teachers are volunteering their time and energy to become involved in activities in which they can work with other teachers. Seventy-eight teachers visited the kindergarten class, 69 participated in the curriculum review workshop, and more than 50 attended the mathematics reform dinner. When asked about the most significant changes that can be attributed, at least in part, to the collaborative, one teacher reported, "[The collaborative] has helped me to know teachers from other schools in this system. The comradeship has been most significantly increased. I gain much from listening and talking with others." As the teachers become acquainted, they feel more comfortable about calling on one another for help. "(The collaborative) gives me opportunities to interact with other teachers locally and nationally," commented one teacher, who added, "I'm not as afraid to call on some of them."

Business has participated in collaborative activities, acting as resources and providing internships to teachers. Representatives of business and higher education have demonstrated their willingness to visit classes by volunteering for the Speaker's Bureau and some teachers have taken advantage of this resource. One person from business is very active on the Advisory Committee and also participated on the Think Tank Committee. Although the collaborative has been able to draw in business representatives at only a minimal level of involvement, it has been able to obtain business participation when needed. Teachers are starting to feel that they have resources available: "[The collaborative] has provided many resources that I can call upon when I need help." What remains less than certain is whether the business community is sufficiently committed to the value of collaboration and to the development of a sound base of business involvement to make that commitment a reality. People who are active in the collaborative clearly have established contacts, especially through the Memphis Urban League. Whether these will prove helpful in the future remains unclear. A question facing the collaborative is whether it will be able to draw from those businesses that are aware of the collaborative in forming the base for the permanence structure.

Representatives of higher education have been more active than their business counterparts in collaborative governance. As a result, teachers and professors have worked together to make presentations, and provide information about writing grants. Colleges have contributed meeting space as well as other resources. Dr. Marshall Jones of Rhodes College chaired the Advisory Committee for two years and was very helpful in the collaborative's formative years. Memphis State University, the largest higher education institution in the area, has not yet become involved in the collaborative. This institution is active in teacher training and is key to the entire mathematics education environment in the Memphis area. A Memphis State University professor is the driving force behind the Memphis Area Council of Teachers of Mathematics, which includes teachers active in the collaborative. MSU involvement in the collaborative is noticeably absent and should be considered as an important step toward increasing the collaborative's influence in Memphis, as well as in adding another source of support to the collaborative.

An important form of collaboration continues to develop between the collaborative and the school district. This relationship is supported by the director of the Optional Schools and Ford Foundation Program who has been very helpful in processing requests and plans through the school system. The collaborative's relationship with the school district requires coordination, however, and has therefore imposed some restraints on the collaborative's efforts to seek independent funding. The Memphis City Schools has been involved in a major fundraising drive and was opposed to the collaborative's plans to request funds from community businesses at the same time. As a result, the Memphis City Schools emerged as a major funding source for the collaborative. Although the mathematics curriculum coordinator has worked with the collaborative and has been receptive to curriculum recommendations that come out of the collaborative, the three mathematics supervisors have not been involved with the project. The supervisors, who are responsible for observing, evaluating, and working with teachers, are an important factor in teachers' professional lives and could constitute a valuable link between teachers and the school district.

## Professionalism

Members of the MUMC were very active in professional activities during the 1988-89 school year. These activities ranged from efforts toward curricular reform to participation in professional conferences. In regard to curricular reform, the fifth-year mathematics course Introduction to College Mathematics was developed by collaborative teachers between February and July 1989 as an alternative to calculus. The proposed course included statistics and other topics supported in the NCTM Curriculum and Evaluation Standards. The course documentation was submitted to and passed the local board but failed to receive approval from the state Board of Education. The state denied addition of the proposed course to its approved list because various courses already on the list contained identical elements. Rather than allowing the issue to die, the teachers added the topics to another course on the state-approved list; the course will be offered to students under the state title Advanced Algebra.

The efforts of a subcommittee of the Teacher Committee also exemplified the pressure that collaborative teachers have begun to exert on the system. The subcommittee developed a statement on the changes that were needed districtwide if the NCTM Standards were to be implemented. The statement expressed the need to have more computers available for mathematics classes. The subcommittee shared a draft with the Advisory Committee, which suggested that it was a little strong. The teachers incorporated the Advisory Committee's suggestions, and then submitted the statement to the Deputy Superintendent. Both the preparation of the new course and the writing of the statement are indicative of the MUMC teachers' determination to affect change. They also provide examples of teachers who are willing to pursue an issue until some action is taken. In both cases, teachers worked to influence policy makers, to bring change to the mathematics curriculum by working within the system to make it happen.

The collaborative has provided mathematics teachers with opportunities to attend professional meetings and conferences, including the NCTM annual meetings and the conferences held at Phillips Exeter and the North Carolina School of Science and Mathematics (NCSSM). Ms. Lana Solomon, an MUMC teacher, made a presentation at the Orlando NCTM annual meeting. For some teachers, attending such meetings is a new experience that has resulted in an enhanced sense of professional involvement. "The collaborative gave me the opportunity to attend my first NCTM annual convention," one teacher noted. "I even joined NCTM as a result." Another teacher commented on the increased professional opportunities, "MUMC has given me the opportunity to do the things I wouldn't have done." There still is a need, however, to generate greater interest in attending professional meetings among a wider group of teachers. Much to the surprise of the collaborative administration, only 14 applications were received to fill the 12 spots open for the NCTM annual meeting. Professional activities in Memphis are increasing because of the collaborative, but a larger number of teachers needs to become involved in leadership roles.

In previous years, many of the professional activities available to MUMC teachers were provided by groups outside of Memphis, including EDC, NCSSM, and NCTM. This year, the collaborative took steps to be more aggressive in identifying professional opportunities and in generating some of its own. Teachers, individuals, and teams applied and were accepted to attend such special institutes as the Ohio State University Calculator and Computer PreCalculus Project and the University of Illinois - Institute for Statistics Education. Collaborative teachers submitted two grant proposals to the Department of Education. One of the grants asked for funding for a graphing calculator project that would correspond with the focus on the NCTM Standards, and one asked the Department of Education to support a middle-grades project on algebra, geometry, and probability.

MUMC Coordinator Nancy Gates has emerged as an active leader in structuring the national UMC network. She helped to facilitate the meetings of the UMC coordinators and serves on the UMC Steering Committee. She also made a presentation at the Teacher Networks Group meeting in Washington, D.C. on December 2, 1988. In this presentation, she defined a professional as "someone with expertise in a field who can make intelligent decisions without constant supervision, and benefits from association and collegiality with others in the field." She contrasted the definition of a professional teacher with a teacher who is presented with a teaching model, a day-by-day curriculum, no time to associate with colleagues, limited opportunities or support to attend professional conferences, and only a minor voice in setting policy and future direction. Her presentation concluded with a description of the collaborative's efforts to alter the situation. The presentation was very well received as a concise depiction of a teacher's view on professionalism. This presentation and her work for the UMC project suggest that Ms. Gates has increased her own level of professionalism by taking the time to become more involved at a national level and to work with a group of her colleagues nationwide.

The collaborative clearly has made an impact on mathematics teachers in Memphis. This impact is frequently reported as a change in attitude that has created more confidence and a willingness to try new ideas. When asked about the impact of the collaborative, one teacher commented, "My attitude is more positive; I don't feel as isolated in the class." Another one said, "I feel [I have] a vote of confidence about what I'm doing in my classroom." A third teacher reported, "I am more willing to try new ideas in classes now." The changes that the collaborative have brought about have given teachers a sense of importance. "I now feel that what I'm doing is important. I feel others are also interested in what I'm doing." Ms. Gates summarized the change in professional environment in Memphis because of the collaborative in this way:

> Teachers are beginning to update, they are talking to one another, and beginning to set direction for the future of mathematics education in Memphis. Through the collaborative, teachers have found a resource group to call on for help or advice when needed. The days are still hectic, but some teachers are beginning to feel better about what they do and are looking for ways to make things change even more. They believe they have the knowledge, expertise and responsibility to make mathematics education meaningful for today's students, and they believe they can make a difference.

## Mathematics Focus

MUMC's mathematics focus has centered on providing a variety of experiences over the range of content in the secondary mathematics curriculum. During the 1988-89 school year, the collaborative emphasized the NCTM Standards, beginning the school year with a presentation and day-long district in-service on the Standards. As a follow-up to the in-service, teachers prepared a statement to the school board on what was needed to implement the Standards, and they also began to plan curriculum aligned with the Standards. In noting the effects of the collaborative, a teacher responded, "I've tried to incorporate the Standards--I use calculators." Another teacher reported, "I have begun stressing how what we learn will be useful for the student. I incorporate real life situations more. It makes me more conscientious and organized in my presentations."

Particular attention was paid to the higher-level mathematics courses, which included the development of the Introduction to College Mathematics course, a workshop on BC calculus, and the Woodrow Wilson One-Week Summer Institute on Functions. The use of technology was addressed at some of these conferences, and also was the focus of a workshop on the Geometric Supposer software and the NCSSM Mathematics and Computer Workshop.

MUMC teachers discussed pre-algebra and algebra, along with higher mathematics courses, at the curriculum review workshop in May. This workshop was designed to provide collaborative teachers the opportunity to have input into curriculum changes. The availability of computers is an issue that surfaces continually when teachers talk about curriculum reform. Mathematics classes in Memphis currently have limited access to computers. The collaborative has been able to help a few teachers acquire computers, but teachers still view the lack of computers as a barrier to curriculum reform. The discussion of this issue at the Algebra I workshop illustrates what teachers see as problems and highlights a difference in view as to whose problem it is. One teacher said, "We need computers, so we must learn how to write proposals . . . ." Another teacher responded, "It is not the teachers' role to write the grants . . . [teachers] should be prepared to tell [administrators] what we need." A third teacher raised the issue that students should come to her class computer literate when she said, "I don't have the time to teach computing in Algebra I." This was followed by a teacher reporting, "We are not asked to teach computer programming skills. We need to use computers to enhance teaching and learning." This dialogue illustrates some of the issues and the complexity of using computers in algebra classes when adequate hardware is unavailable. Teachers in Memphis have begun to discuss these issues and to address ways to foster change.

The collaborative has been influential in helping mathematics teachers gain a national perspective on the status of mathematics. A teacher from the Philadelphia collaborative presented a workshop on the Geometric Supposer. A number of teachers have attended conferences and institutes in different locations across the country. A professor from Valparaiso University presented a talk on inequalities, limits, and proofs. As a result, teachers have become knowledgeable about national trends and have come to recognize the areas where change is needed. "I look at the [curriculum] more globally -- not chapter by chapter," commented one teacher. "I want to update [the curriculum] to include ideas promoted nationwide by important university math leaders. I feel it leaves out important concepts that need to be taught."

Although collaborative activities have touched on topics across the curricular spectrum, the activities are weighted towards the more advanced courses. Discussion on general mathematics and its role in the curriculum has occurred in only a few workshop sessions. Teachers of these courses have exchanged ideas at the Swap Shop and have found it valuable to talk with one another. A proposal was submitted by LeMoyne-Owen College to work with general mathematics students. A concentrated effort at this level, however, has not evolved.

The leadership in curriculum reform that is being exerted by the collaborative in Memphis has been impressive. As noted above, teachers are encouraged to reflect on what they are doing, to see what needs to be done differently. The collaborative has fostered in teachers the courage and knowledge to try new ideas. Students are benefitting from their teachers' excitement. One teacher observed, "Students know I am interested and that I participate in extra activities. They know I try to keep updated. This motivates them." Another teacher supports this: "I try to stress what's happening nationally . . . that motivates them to work better. They are trying to learn more 'why' they are doing things."

## F. Next Steps

Over the next two years, the Memphis Urban Mathematics Collaborative will develop its permanent structure. This will include forming a Governing Board and an Operating Committee and transferring the control of funds from the Memphis Urban League to the Governing Board. A permanent host agency will be sought. Grant proposals have been submitted and, if approved, new projects will be set into motion. These include a proposal to the National Science Foundation to design teaching modules on geometry, statistics, and probability using computers for grades 5-8, and a proposal submitted by LeMoyne-Owen College for mathematics enrichment, statistics, and remediation for general education. Other new activities and ideas will come from the teachers who attend a variety of institutes and conferences during the summer, 1989. There is interest in expanding the collaborative to include elementary teachers. The collaborative will continue to be responsive to the Memphis City Schools' initiatives and will be particularly alert to opportunities to assist deregulation schools in their mathematics programs.

# SUMMARY REPORT:
# NEW ORLEANS MATHEMATICS COLLABORATIVE (NOMC)

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the New Orleans Mathematics Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its third year have evolved in order to reach that goal.

The information presented in this report was culled from the following sources: the reports submitted by the Metropolitan Area Committee Foundation; documents and interview information provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

## New Orleans Mathematics Collaborative (NOMC)

### A. Purpose

As stated in the proposal submitted to the Ford Foundation, the goal of the New Orleans Mathematics Collaborative (NOMC) is to enhance the professional development of secondary school mathematics teachers in the New Orleans Public Schools and to enrich the teaching of mathematics by providing opportunities for teachers:

1. to become part of a network of mathematicians;
2. to work in collaboration with mathematics teachers and other mathematicians in addressing both teacher and student needs;
3. to keep abreast of developments in the fields of mathematics and teaching; and
4. to experience first hand the ways in which mathematics is used outside the academic setting.

### B. Context

The New Orleans metropolitan area has a population of 1,337,400, with approximately 570,000 people living within the city limits of New Orleans. During the 1950s and 1960s, a steady migration of white middle-class residents to the city's suburbs left behind an economically impoverished population in the inner-city. In 1980, New Orleans was ranked as the third poorest city in the nation, with 26 percent of its citizens living below the poverty line.

The City of New Orleans, despite severe financial difficulties, is building a new million- square-foot convention center. The center is expected to bring billions of dollars into the area's economy over the long term. Tourism has become one of New Orleans' primary industries, and the convention center, along with a new aquarium to be completed at approximately the same time, is expected to capitalize on the city's growing number of visitors. The Republican National Convention, held in New Orleans in August 1988, added a needed boost to the local economy and provided positive press coverage for the city. In addition, Texaco is closing down offices in the Eastern Seaboard and Gulf Regions and is expanding its operations in New Orleans, establishing the city as one of its two regional bases. Despite problems in the petroleum industry, New Orleans is still a large and important oil exploration and production center.

The New Orleans Public Schools District (NOPSD) is the 26th largest school system in the United States. It consists of 127 schools serving approximately 80,000 students. This represents decreases of about 9 percent in the number of schools and 3 percent in the number of students since 1986-87. During the 1987-88 school year, 49 percent of the student population was female and 51 percent was male. Approximately 88 percent of the students were black, 7 percent were white, 3 percent were Asian, 2 percent were American Indian and 2 percent were Hispanic. Of the students in the NOPSD, approximately 1 percent consider English their second language. One-third of all students in the system are from families that receive AFDC support, and 81 percent participate in government-funded lunch programs.

Approximately 17,000 students were enrolled in the district's 19 core curriculum high schools (grades 9-12) during 1987-88. In addition, there were five specialized programs for secondary students. Fifty-three percent of the high school students were female and 47 percent were male. Ninety percent of the high school student population was black, 5 percent was white, 3 percent was Asian, 2 percent was Hispanic, and less than one percent came from other ethnic groups. Nine percent of the high school students considered English a second language. Twenty-one percent of high school students in the system came from families that receive AFDC support, and 75 percent were eligible for federally funded lunch programs. Based on current trends, only 50 percent of the children entering the public school system today are likely to graduate from system high schools, with the majority of dropouts leaving school in the ninth and tenth grades.

Louisiana students are required to take Algebra I, Algebra II and Geometry to graduate. Of the 10,000 ninth and tenth graders who took mathematics courses in the 1987-88 school year, 55 percent were male and 45 percent were female. Information was unavailable for eleventh and twelfth graders.

The mean ACT mathematics test score of the 1987 graduating class was 12.8 compared with 18.7 in the national sample, with a possible range of 1 to 36. NOPSD elementary students ranked near the bottom nationally on the Comprehensive Test of Basic Skills (CTBS). Grades 4, 5 and 9 scored lower in reading, and grades 4, 5, 6 and 7 scored lower in mathematics in 1987-88 than in 1986-87. At the same time, eleventh graders' scores on the (CTBS) were the highest in 1987-88 they have been since 1983-84; eleventh graders scored in the 35th percentile in 1988 versus the 22nd percentile in 1984 in reading, and the 41st percentile in 1988 versus the 30th percentile in 1984 in mathematics.

Seventy percent of the 380 newly hired teachers in the district have some prior teaching experience. The district has suggested that this reflects not only a state pay raise, but also the rehiring of teachers and administrators from newly closed public and parochial schools in the area; it should be noted, however, that many of the new teachers have come to New Orleans from school districts in other states.

Approximately 1,200 high school teachers were employed by the district in 1986-87. Of these, 64 percent were female and 36 percent were male. Sixty-eight percent of the high school teachers were black, 30 percent were white, and 2 percent were from other ethnic groups. Annual salaries for teachers ranged from $16,000 for a beginning teacher to $26,000 for a teacher with a doctorate and 14 years of experience. Teacher salaries currently average $23,000 per year. In June, 1988, the state legislature approved an education plan that included a 5 percent increase in teachers' salaries, the first statewide increase in several years. The plan also set requirements for a statewide teacher evaluation system, eliminated lifetime certification and introduced mandatory recertification every five years.

During the 1987-88 school year, 286 secondary school (grades 6-12) teachers taught mathematics. Of these, 67 percent were female and 33 percent were male. Seventy-five percent of mathematics teachers were black, 23 percent were white, and 2 percent were Asian. Less than 1 percent were from another ethnic group. Forty-two percent of mathematics teachers held at least a master's degree, and 99 percent held at least a bachelor's degree. Of the total, 91 percent held regular teaching certification, 8 percent were not certified, and 1 percent had temporary or emergency certification. Eighty-four percent of secondary school mathematics teachers were tenured. There are approximately 150 senior high school (9-12) mathematics teachers.

Dr. Everett Williams continues to serve as system superintendent, a position he has filled for the last six years. His contract, which was renewed in 1989, expires in August, 1991. Ms. Louvinia Wallace has been hired to fill the position of district mathematics supervisor, which became vacant when the supervisor became a principal.

As a result of the restructuring of the Orleans Parish School Board, a new seven-member board (five members elected by district and two members elected at large) took office January 9, 1989. The new board replaces the at-large board which had been in place for the past 77 years. All of the new members will serve four-year concurrent terms.

In 1987-88, the NOPSD's budget totalled approximately $225 million. Fifty-four percent of total revenues came from state funds, 43 percent from local monies, 2 percent from federal reserves and 1 percent from outside sources. The budget allocated $94 million for construction or building improvement in district schools. In April, 1988, New Orleans voters approved 85 percent of a proposed 19.4 property tax millage increase, which represents about $16 million per year in increased school revenues. These funds will be used to help pay for school construction, renovations, teacher salaries, new programs, instructional equipment and textbooks. Voters rejected Proposition E, the portion of the millage increase that authorized the issuance of bonds to fund new construction. Governor Buddy Roemer later proposed cuts of as much as $29.5 million in state education funds. He projected that there would be at least 2,000 layoffs and that a minimum of 4,000 jobs would be cut through attrition in an effort to balance the state budget. The state deficit may reach $2 billion by 1992.

On April 29, 1989, voters defeated a referendum that would have removed the homestead exemption from 20 mills of property taxes due the city. The homestead exemption protects the first $75,000 of a home's value from taxation. Removal of the exemption would add $150 to the yearly tax bills of homeowners with homes valued at $75,000 or higher. Homes worth less than $75,000 would pay a percentage of the $150 depending on the estimated value of the property. The provision would have contributed nearly $5 million to city coffers. In other state action, legislative committees have approved a state lottery. In October, 1989, the Senate and the House will vote on whether to put the lottery on the ballot.

Wilmer "Bill" Cody, former superintendent of Chapel Hill schools, became Louisiana's first appointed state superintendent of education. His goals for the state include: higher state pay for teachers to attract and retain qualified staff, higher standards including stricter high school course requirements and a mandatory 11th grade exit examination required for graduation, and a system of evaluating schools to identify superlative schools and to determine those that need help.

Governor Roemer has warned Louisiana school districts that he may terminate state aid to local school boards that have not reduced class sizes in kindergarten through third grade to the 20:1 ratio mandated by state law. The governor also has allocated more than $1 million in federal money to address the problem of illiteracy in Louisiana. Patti Roemer, the governor's wife, is leading a statewide task force dedicated to attacking illiteracy on all levels--in the marketplace, in the home and in the state prisons. Recent studies have shown that Louisiana has a higher than average percentage of adults with marginal or no reading and writing abilities.

Due to national reports that ten mathematics and science teachers leave the profession for every new teacher who enters, a New Orleans group called the Louisiana Executive Service Corps is recruiting retiring engineers and scientists to become teachers. In January, 1989, the University of New Orleans began a program in which retired engineers and scientists can take education courses at night to qualify them to be teachers. Participants who began the program in January, 1989, were eligible to begin teaching in September, 1989.

In May, 1989, more than 4,400 NOPSD students were honored by Superintendent Williams for outstanding achievement in one of the largest academic awards ceremonies in the history of the New Orleans Public Schools. Well over 9,000 parents and friends attended the breakfast to see the straight-A students being recognized and honored.

Several New Orleans schools received national recognition during the 1988-89 school year. Benjamin Franklin Senior High was named one of the outstanding secondary schools in the United States by the U.S. Department of Education. Franklin is the first NOPSD high school to win the award and one of only five winning schools in Louisiana. Franklin, currently housed in an overcrowded building, is awaiting the completion of a new school which is under construction at the University of New Orleans. Lawrence Pijeaux, Jr., principal of the L. B. Landry Magnet School, was named a Reader's Digest American Hero in Education. Ten educators or teams of educators were chosen from more than 600 entries from around the country. The national award gives Pijeaux $10,000 to use in his school as he sees fit to continue to improve education.

The Portal Early Field Experience Program, a cooperative venture between the University of New Orleans and the New Orleans Public Schools, has been implemented to give education majors who are aspiring teachers hands-on experience with elementary school students before they enter the profession. University mentors who work with the college students appreciate the opportunity to evaluate the newest research-based teaching methods.

Xavier University has initiated a Master of Arts degree in Teaching in Computer Science. The first graduate students to receive the degree are members of the NOMC. Claudette W. Tolbert, teacher of marketing education at Cohen Senior High, and Stella C. Williams, mathematics/computer science chairperson at McDonogh Senior High, will bring their new expertise to the classroom to teach students advanced computer techniques.

The Public Schools Scholarship Foundation is in its fourth year. In March of each year, the district conducts a fund drive in which each student and each employee of the public schools is asked to contribute one dollar. In 1988, the "Dollars for Scholars" drive raised $107,743. This money will help promising but poor students attend colleges they ordinarily could not afford. Students who received aid from the first drive in 1984 are currently college seniors who should graduate this spring.

The Louisiana Science Centre and IMAX Theatre, scheduled to open in 1989, will provide on-site classrooms for seminars, school visits, internship programs, and summer and after-school programs. The Centre has already instituted an outreach program, taking demonstrations to local schools and presenting workshops. A Mathematics Resource Centre is planned and will be available for use by teachers and their students during the 1989-90 school year.

## C. Development of the Collaborative

The New Orleans Mathematics Collaborative is one project of the Metropolitan Area Committee (MAC) Education Fund. MAC is a nonprofit, citizen's action organization whose membership includes representatives from business, labor, professional, academic, and religious communities in the greater New Orleans area. In addition to overseeing the collaborative, the MAC Education Fund oversees the Community Awareness Project, Partnerships in Education, and Mini-grants for Teachers Program. On July 1, 1988, Ms. Kimberley Sawyer was appointed the director of the Education Fund and, as such, serves as the director of the New Orleans Mathematics Collaborative. Dr. Olympia Boucree is the collaborative's coordinator, a position she has filled since the project's inception. The executive vice president for MAC, former Collaborative Director Ms. Constance Barkley, served as interim collaborative director until Ms. Sawyer was appointed, sharing the responsibilities with Dr. Boucree. Ms. Aldonia Winn-Belton, a mathematics teacher at Clark Senior High School, is the on-site observer.

## Steering Committee

The collaborative is governed by a Steering Committee of 22 members, including five business representatives, four representatives from higher education, six teachers, two representatives from the New Orleans Public Schools, one representative from the teachers' union, two representatives from the Louisiana Science Centre, and the collaborative director and coordinator. The Steering Committee monitors and evaluates programs, and serves as a think tank to solve problems and create new initiatives. Mr. R. L. Howard, Chief Executive Officer of Shell Offshore, Incorporated, continued to serve as the chairman of the committee, a position he accepted in fall, 1987.

The Steering Committee, scheduled to meet quarterly, held three meetings during the school year. Its first meeting was held Wednesday afternoon, November 16, 1988, from 4 to 5 p.m. in the conference room of One Shell Square. Nine committee members attended. Dr. Boucree reported on the collaborative's activities and each of the four Steering Committee subcommittees--Symposium, Workshop, Site Visit/Internship, and Newsletter--presented its short- and long-range goals. The short-range goals, which identified specific outcomes, included conducting two symposia annually, sponsoring a minimum of six site visits during the school year, and publishing three issues of the newsletter each school year. The long-range goals specified more general outcomes and included the interaction of teachers with colleagues in business and universities; professional development for mathematics teachers; improvement of teaching of mathematics in the New Orleans Public Schools; and encouraging the contribution of news articles for the collaborative newsletter, thereby providing a networking system among teachers and representatives of business and higher education. The Steering Committee agreed on a set of recommendations to forward to the MAC Education Fund Long-Range Planning/Program Committee. This action culminated nearly a year of effort that began in February, 1988, when Steering Committee Chair R. L. Howard requested that each subcommittee develop both long-range and short-range goals. At the conclusion of the meeting, Mr. Howard asked Dr. Boucree and Mr. Billy Vehnekamp, public affairs manager for Shell Offshore, Incorporated, to develop guidelines for filling Steering Committee membership vacancies and to report on them at a subsequent meeting.

The second meeting of the Steering Committee was held Thursday, April 6, 1989 from 4 to 5 p.m. at One Shell Square. Thirteen committee members attended. Dr. Boucree reviewed collaborative activities and the chair of each of the four subcommittees reported on current progress. The chair of the Symposium Committee, Dr. Gordon Saussey, told the group that teachers had suggested future symposia be structured such that the speaker is followed by discussion break-out sessions. Collaborative Director Kimberley Sawyer then led a discussion on the issues relating to collaborative permanence, including funding and procedures for selecting members of the Steering Committee. In other action, the Steering Committee recommended that its chair serve a two-year term and that its vice-chair assume the position the third year. Members on the Steering Committee will serve two-year terms that can be renewed for one additional term. Membership of the committee will be selected from four sectors--business, civic, school, and university communities. Seats on the committee will be designated for a representative from United Teachers of New Orleans, a mathematics supervisor of NOPS, a representative from the Louisiana Science Centre, and two members of the Teacher Leadership (Advisory) Council; the on-site observer will serve as an ex-officio member.

The Steering Committee met for the last time during the 1988-89 school year with the Teacher Advisory Council, at One Shell Square, Friday, June 16, 1989, at 2 p.m. A total of 14 people, including eight teachers, two district administrators, two representatives from MAC, and two from Shell Oil, Incorporated, were in attendance. Participants discussed the governing structure of the collaborative and clarified the sharing of responsibilities between the Steering Committee and the Teacher Advisory Council, as well as the duties of the coordinator. The group outlined in detail the purpose and activities of the Peer Support Group that was to be established under the permanence plan. In addition, they reviewed current out-of-school activities and planned for the future. The group decided to sponsor one annual symposium instead of two as part of the networking activities; to allocate $5,000 annually to support teachers' attendance at conferences; and to continue to publish the collaborative's quarterly newsletter.

Much of the work of the Steering Committee occurs through its four subcommittees. Each subcommittee meets as needed to address its specific area of responsibility. Dr. Boucree, as collaborative coordinator, attends each subcommittee meeting.

## Symposium Subcommittee

Dr. Gordon Saussy of the University of New Orleans chaired the Symposium Subcommittee. This committee, comprised of six members, is responsible for planning and evaluating the winter and spring symposia that have been presented each year. The subcommittee met once during the year, at which time guidelines for the symposia were defined. It was recommended that the group make efforts to bring in more minority speakers for the symposia. The long range goals for the Symposium Subcommittee are:

1. to provide an informal atmosphere in which teachers are able to meet their colleagues in business and universities, as well as one another, while they also have opportunity to interact with speakers on a variety of mathematics-related topics; and

2. to provide other opportunities for professional development, including supporting teachers' attendance at conferences and conventions.

## Site Visit/Internship Subcommittee

Dr. Ron Masters of Shell Offshore, Incorporated, chaired the five-member Site Visit Internship Subcommittee, which met in January, 1989. The long range goal of this committee is to improve the teaching of mathematics in the New Orleans Public Schools by providing:

1. a long-term, ongoing internship program;

2. an opportunity for teachers to translate real-world experiences into their classroom experiences;

3. a forum for discussion and interaction among high school teachers, university professors, and business persons, thus reducing teacher isolation; and

4. the opportunity for increased involvement in the educational process through informal contact with businesses and universities.

The committee planned the five site visits that were held during the year. The site visits are planned such that only one teacher from each high school is eligible to attend; this restriction was implemented in order to accommodate the host business and to reduce the number of mathematics teachers who would be absent from any single school. The subcommittee also sent letters to eight companies to invite them to participate in the summer internship program. They received a favorable response from four of the eight.

## Workshop Subcommittee

Ms. Louvinia Wallace, a mathematics specialist from the NOPS, chaired the four-member Workshop Subcommittee. The long-range goal of the committee is to provide resources for the professional development of mathematics teachers. The general approach recommended by the subcommittee is to use a small group structure so that teachers and presenters can exchange ideas and experience hands-on activities on topics based on identified need, or interest generated by a symposium. This group did not meet formally during 1988-89.

## Newsletter Subcommittee

Ms. Ella Butler, a teacher at Rabouin Senior High School, assumed the responsibility of newsletter editor. The Newsletter Subcommittee is comprised of the chairs of the other three subcommittees. The group's long range goal is to provide a forum for news articles that will be of interest to teachers and to representatives of the business and university communities. The committee plans to broaden the distribution of the newsletter to include all mathematics teachers and a number of representatives from the business community. The number of business leaders that will receive the newsletter will, at minimum, equal 25 percent of the total number of teachers on the distribution list. In addition, members of the business community will be encouraged to submit articles for publication. The subcommittee hopes to recruit a representative of the business community to be a co-editor; by the end of the school year, however, a business person had not been identified to assume this position.

## Teacher Advisory Council

The Teacher Advisory Council (TAC), established in July, 1987, is composed of one teacher from each of the 19 high schools. The Council meets as needed. During the 1988-89 school year, the Council met four times, one of which was a joint meeting with the Steering Committee. The Council received an allocation of $2,500 from the NOMC to award teacher travel grants and is responsible for deciding which teachers are to receive the funds to attend various conferences. Council members are responsible for sharing information that is discussed at their meetings with the teachers in their schools.

The Teacher Advisory Council's first meeting of the year was held October 27, 1988, at 4 p.m. at McDonogh 35. Eight committee members attended. Information was provided about the NCTM conference in Baton Rouge November 3-5, 1988, and the annual meeting in Orlando, Florida, April 12-15, 1989. Council members expressed concern about the restrictive effect of the policy to limit support for attendance to NCTM members. The mathematics coordinator discussed a seminar to be held December 1, 1988, with follow-up workshops December 2 and 3 for high school and elementary schools teachers, respectively. Details about the 1989 Woodrow Wilson Institute also were discussed. In addition, Collaborative Coordinator Dr. Boucree asked Council members for suggestions about the collaborative's permanence proposal.

Sixteen people, including Superintendent of Schools Dr. Everett Williams, attended the second meeting of the Teacher Advisory Council Thursday, January 19, 1989, from 4 to 5:30 p.m. at the Hyatt Regency Hotel. At this meeting, Ms. Sadie Hutchinson, McMain Magnet School, was elected chair and Ms. Frances Anderson, Lawless High School, was elected co-chair of the Council. Topics of discussion included site visits, both those that had occurred and those planned for the future. Members were asked to encourage teachers within each department to take advantage of the opportunity to participate in these visits. The NCTM Annual Meeting in Orlando was discussed and it was noted that the Council had allocated $2,500 to reimburse teachers up to $300 each for travel expenses and registration fees. Guidelines were developed to select teachers to attend. The Council decided that announcements of the availability of financial support would be sent to teachers January 31, with applications due back February 13. In other business, Dr. Boucree asked the Council for feedback on collaborative priorities in anticipation of a decrease in funds for the following year. Council suggestions included site visits; sharing mathematics problems and lesson plans among teachers; and decreasing the costs of the symposia. At the meeting, Dr. Williams announced that Iowa State University in Ames, Iowa, would award five full scholarships to minority mathematics teachers to pursue master's degrees beginning in fall 1989.

In addition to these two meetings, the TAC helped to sponsor the end-of-the-year planning meeting on June 8, 1989 (discussed under Project Activities), and the June 16 joint meeting with the Steering Committee. Four teachers were selected to attend the UMC Leadership Conference to be held in Newton, Massachusetts, in August, 1989; two will be funded by the collaborative and two by EDC. These teachers were selected by the collaborative director and coordinator from among the teachers who were frequent participants in collaborative activities.

## Planning for Permanence

Preparation of the permanence plan began in the 1987-88 school year, with Mr. Howard directing the chairs of the four subcommittees to develop long range plans. These plans were approved by the Steering Committee as a whole and then forwarded to the MAC Education Fund Board for its review. The MAC Foundation approved the subcommittees' long-range plans. These governing groups, as well as the NOPS Associate Superintendent of Education Programs Linda Stelly, had input into the revised structure that was being proposed to enable the collaborative to meet its long-range plans. The actual permanence proposal was drafted by the NOMC staff and then shared with representatives of the Steering Committee, Teacher Advisory Council, the school district, and EDC. In addition, a proposal was submitted to the National Science Foundation for a grant to fund a Mathematics Network. While this attempt to solicit funds from outside of New Orleans (the first that the collaborative had made) was not approved, the grant-writing process helped to foster ideas that contributed to the development of the permanence proposal submitted to the Ford Foundation.

Four goals were culled from the subcommittees' long-range plans:

1. provide an informal atmosphere where teachers are able to meet and interact with their colleagues in business and universities, as well as with one another, while having the opportunity to interact with speakers on a variety of mathematics-related topics;

2. provide opportunities for professional development of mathematics teachers;

3. improve the teaching of mathematics in the New Orleans Public Schools; and

4. provide an expanded communications networking system for teachers, business persons and university personnel.

Proposed activities were categorized into out-of-school activities (site visits, internships, and workshops); in-school activities (mini-grants and peer-support groups); and networking (symposia, conferences, and newsletter). It was intended that the proposed peer-support group would link teachers with expertise to teachers in need of assistance. It also was envisioned that this assistance could be made available in workshops, at department meetings, and in one-on-one interactions between teachers. In addition, in 1989-90 the name of the Teacher Advisory Council will be changed to the Teacher Leadership Council. This change of title represents more accurately the intent of the collaborative and signifies that a group of teachers will provide leadership rather than act only as advisors.

In June, Dr. Barbara Scott Nelson responded to the permanence proposal. In her letter, Dr. Nelson acknowledged the breadth and depth of the collaborative's vision but requested a more precise plan as to how the changes will be made and a clarification of five issues. The collaborative's response drew upon input from the June 16 joint meeting of the Steering Committee and Teacher Advisory Council, and clarified several points. First, a two-year term was set for membership on the Steering Committee. Second, specialized seats on the Steering Committee will be allocated to members of the teachers' union, school district, Louisiana Science Center, the on-site observer and the Teacher Leadership Council. Third, contingency funds will be split evenly between the two years; the proposal supplement also detailed how the activities would be implemented. Fourth, the Teacher Leadership Council will be comprised of one elected representative from each of the 19 secondary schools, and from those schools with students in any of the grades 7 through 12. Fifth, the length of a member's term on the Council was set at two years.

## D. Project Activities

During the 1988-89 school year, the New Orleans Mathematics Collaborative sponsored a variety of activities to provide opportunities for public secondary school mathematics teachers to interact with one another, as well as with their colleagues in business, industry and academia; to stay abreast of new developments in the fields of mathematics and mathematics education; and to gain firsthand experience in the ways in which mathematics is used outside of the school setting. The collaborative also encouraged teachers to participate in a Mini-Grant Program sponsored by the Education Fund of the Metropolitan Area Committee.

### Dinner Symposia

#### Fall Symposium and Follow-Up Workshops

On December 1, 1988, NOMC sponsored the first of two dinner symposia for the 1988-89 school year. The symposium, which was held at the Hyatt Regency Hotel, featured Academic Foundations Professor Dr. Arthur Powell of Rutgers University. The evening began with a social hour, followed by a short welcome address by Billy Vehnekamp, public affairs manager of Shell Offshore, Incorporated. MAC Education Fund Director Kimberley Sawyer then introduced Professor Powell, who spoke on "Strategies in Working with Underprepared Students." Some of the strategies that Dr. Powell discussed in his address included journal writing activities; "solidarity group" work; and mastery of mathematics concepts through encouraging students to explore all possibilities of a concept so that mathematics is promoted as a way of thinking rather than just as a body of knowledge. Following dinner, Mr. Venhenkamp led a lively question-and-answer session.

The evening was very successful. Approximately 110 junior and senior high school mathematics teachers, school administrators, and representatives from the business and university communities attended the symposium. The on-site observer reported, "Many were very positive in their enthusiasm and enjoyed the speaker!!" On an evaluation form distributed by the collaborative, most participants rated the event 4 or 5 on a 5-point scale. In an article that appeared in the NOMC newsletter, a teacher wrote, "His [Professor Powell's] talk on 'Strategies in Working with Underprepared Students' was timely and well received. The after-dinner questions and conversations were stimulating and provocative."

In addition to presenting the symposium, Professor Powell led two day-long workshops at the Pontchartrain Hotel to help teachers learn to implement the strategies he had outlined at the dinner symposium. The hands-on workshops focused on how to use writing as a vehicle for teaching mathematics, discovering mistakes, and reflecting and thinking about mathematics.

The first workshop, held Friday, December 2, was open to mathematics department chairpersons. The Orleans Parish School System provided substitutes for the 37 teachers who participated. The teachers seemed to find the workshop extremely worthwhile, with the majority rating it either a 4 or a 5 on a 5-point scale. Many of the teachers commented that they planned to implement Professor Powell's strategies in their classrooms and several requested that Dr. Powell be invited back to do a follow-up workshop. One teacher wrote, "I'm excited about Dr. Powell's concept of solidarity groups. I'll initiate the concept in my classroom . . . ." Another commented, "I thought the workshop was very good and I will try to implement some of the activities." A third teacher wrote, "I know that the information given today will help me and the other teachers in the field. Ask him to return soon." A fourth teacher wrote, " . . . This will work in my school! Thanks!" Another said, "I thought the workshop was excellent and it would be great if Dr. Powell could return to do a workshop for some of the other teachers that were not present today." In an article that appeared in the NOMC newsletter, a teacher wrote, "He is teaching Algebra but he is also teaching [students] how to be self-reliant. The latter is so vital to their continued success in college as well as in the working world." A few of the teachers felt that while the strategies presented were important, they were unsure whether they would be able to implement them within the time constraints of their classes. One teacher wrote, "The ideas were very interesting, however with ELO's (Expected Learner Outcomes) and pacing and district-wide exams, time is very limited for writing." In evaluating the workshop the on-site observer reported, "A very good workshop. Most comments were very positive and showed both teacher enthusiasm and involvement."

Dr. Powell presented a day-long workshop for 38 upper elementary school teachers on December 3. Since the workshop was on a Saturday, the Orleans Parish School System paid a stipend to those teachers who attended. Like its predecessor, the workshop was very well received, with the majority of the 27 teachers who completed the evaluation form rating the workshop 5 on a 5-point scale. Many of the participants felt that it was useful, and that they could adapt the strategies to the elementary level, although a few elementary teachers did not feel that the strategies could be incorporated into their elementary school curriculum. In addition, many of the elementary teachers seemed appreciative that a workshop was held for them. One teacher wrote, "Halfway through I knew this workshop would be a ten. The excitement is evident. I will make this a part of my repertoire." Another said, "This workshop has been most beneficial, especially in reference to the holistic approach to teaching. It was most refreshing to have a workshop without teacher's manuals. We, too, had a chance to 'think.'" A third teacher said, "I think this workshop should be done systemwide." A fourth teacher wrote, "Thank you for including upper elementary grades for math workshops. The workshop was very interesting and enjoyable. The ideas were fantastic." The on-site observer reported that the workshop was "well received, but would have been better if all attendees perceived it to be especially for the elementary level. Many were able to see value to the presentation and how they would and could adapt to their elementary level, whereas others were not able to do this!!"

## Spring Symposium

The Spring Symposium, which focused on building leadership, was held May 17, 1989, from 4 p.m. to 7 p.m. at the Hyatt Regency Hotel. Following a social hour and a buffet supper, Sadie Hutchinson, chair of the Teacher Advisory Council, welcomed the participants and introduced panel moderator Wayne Patterson, Vice Chancellor of the Office of Research of the University of New Orleans and National President of Project Seed. The topic "Building Leadership: Issues in Equity, Excellence and Mathematics Curriculum Reform," was addressed by three panelists: Mark Driscoll, of the Education Development Center, Newton, MA; Dr. Anoa Namtambu, an instructor in the Mathematics Department of the University of New Orleans; and Dr. Arthur Powell, the Academic Foundations Professor at Rutgers University. After the panelists introduced the issues, the audience divided into subgroups of 15 to discuss the dilemmas they experience in their daily work. In all four groups, participants were asked to make recommendations for future collaborative work and to suggest possible reform activities to improve mathematics instruction and outcomes for students.

The discussion group headed by Wayne Patterson discussed issues concerning how much mathematics should be required in the curriculum, what topics are relevant and for whom, reasons for poor achievement in the schools, and reasonable expectations of students studying mathematics. The group proposed that channels of communication be opened between secondary and elementary schools so that elementary teachers can understand what students will need when they get to high school. They also suggested that other bridges needed to be built to the community, so that parents and others can reinforce how mathematics is needed in real life.

Mark Driscoll's group addressed how the system needs to be changed so that students will be given the time and attention it takes to learn mathematics, not because of the nature of mathematics, but because of the psychological anxiety most students have concerning it. This group listed specific steps that could be taken to help create an environment in which students would be able to learn more mathematics. Suggested innovations included: teachers planning together; one school developing an action plan that would serve as a model for other schools; sharing among teachers; teachers visiting other teachers' classes to observe; and an attempt to make efforts for change more apparent.

Group III, with facilitator Anoa Nantambu, discussed popular myths about mathematics, including: "Math is for 'smart' people"; "Guys are better in math because they have analytical minds"; "All students can memorize"; and "Asian students automatically do best." Participants addressed specific strategies to combat the harmful effects of subscribing to or perpetuating these myths and suggested techniques to help all students achieve in the mathematics curriculum.

Arthur Powell led Group IV in addressing several questions that need to be answered at a local level, since there are no universal solutions. These questions included: How can we de-mystify math? How do we gain support of the administration in the area of math? and How can we develop standards that are equitable to individual students in a class?" The group stressed the importance of professional dialogue and reached the conclusion that these questions do not have universal answers, but must first be addressed locally. Then, through collaboration, answers can be derived that will be more applicable to the larger system.

Of the 37 teachers who completed an evaluation form, the overwhelming majority rated the event as 4 or 5 on a 5-point scale in several categories, including the practicality of the presentations and discussions; the organization of the in-service; the level of interest in the ideas and activities; and the quality of the consultants' presentations. The average rating of the overall event was 4.4 out of 5. The teachers seemed to be motivated by the discussion and several expressed an interest in continuing to pursue the issues that had been raised. One teacher wrote, "We need answers to questions raised--or at least an attempt." Another said, "We need to present our ideas and problems to the school board or superintendent so they can get acted on." Other comments included: "Very successful. Provocative"; "I enjoyed the symposium and do hope that there are many more to which I can be invited"; "It's always a pleasure to join such a star-studded group"; and "Excellent! The presenters complemented each other and offered challenges for improvement!"

The symposium was videotaped by the district. The videotape has been aired several times on the local education access channel since the symposium.

## Site Visits

The New Orleans Mathematics Collaborative arranged five site visits to businesses and industries during the 1988-89 school year. Four of the sites had hosted site visits the previous two years and one site had hosted a visit in 1987. The New Orleans Public School System provided release time to allow teachers to participate, anticipating that they would acquire practical information to apply in their classroom teaching. Again this year, Coordinator Dr. Olympia Boucree contacted each site to discuss the collaborative's expectations of the visit. Each business then planned the day's agenda and activities, including lunch. The mathematics department chairs from each of the 19 high schools and the ten junior high schools were asked to invite teachers from their schools to participate. Over the past two years, a total of 106 teachers (37 this year and 69 last year) have visited businesses to observe how mathematics is used in the work place. Although some teachers were initially apprehensive, participants are now excited, motivated, and eager to bring the information back to their classes. A collection of mathematical concepts and problems gathered from site visits is being compiled so that all collaborative teachers are able to use the information that is shared during the visits.

### Consolidated Natural Gas Site Visit

On January 18, 1989, 11 senior high mathematics teachers representing 11 schools participated in an all-day site visit to the Consolidated Natural Gas Company. NOMC Director Kimberley Sawyer and Mathematics Specialist Louvinia Wallace also participated.

This was the third year that the company had hosted a site visit. The teachers heard presentations by four company officials on how mathematics is used in their individual departments. The speakers stressed the mathematical skills needed for specific jobs, and provided handouts containing examples that could be used in the classroom. The presenters also offered to visit the schools and talk directly with students.

The program was very well received. The 11 teachers who completed a written evaluation reported that the topics presented at the site were very useful to them as classroom teachers. With the exception of Basic Math Skills and Computer Usage areas, the majority of teachers rated the usefulness of the information to classroom instruction a 5 on a 5-point scale. The teachers also reported that they had observed applications of concepts taught in high school mathematics during the site visit, with the majority of teachers assigning this measure a rating of 5. Asked to select the adjective that best described their feelings about the site visit, of the nine teachers who responded, five selected "excited," three chose "involved" and one chose "inquisitive." One teacher wrote, "This has to be one of the better seminars. The speakers were enthusiastic, knowledgeable and sincere in their efforts to impart knowledge. I'm very impressed with the preparation and direct application of the real business world to the field of mathematics." Another said, "It was a very interesting, involved workshop. The material could be easily adapted for senior high school students in higher forms of math." A third teacher wrote, "Very good relevant information for future use to inspire and cultivate interest in these various fields." The on-site observer did not attend the site visit, as she had gone to Consolidated Natural Gas the previous year, but she reported that "the participants were excited about and involved in this site visit. Very good interaction."

## New Orleans Public Service, Incorporated and Louisiana Power and Light Site Visits

On February 23, 1989, seven teachers from the New Orleans collaborative participated in the on-site visits to the New Orleans Public Service, Incorporated and Louisiana Power and Light. This was the third visit to these sites sponsored by the collaborative and participation was extended to mathematics teachers who had not participated in previous visits. During the morning, engineers and other staff discussed the uses of mathematics in providing electricity and gas. In the afternoon, the teachers visited the Waterford III facility in Taft, Louisiana, where they had lunch and toured the plant. The Waterford III facility, located about 35 minutes from New Orleans, is a nuclear energy power plant.

Since the generator is not open to the public, teachers were provided a detailed explanation of the workings of a simulator.

The teachers reported that the site visit was very worthwhile. Their written evaluation forms indicated that the information presented had applications for the classroom, with the majority of ratings being either a 5 or a 4 on a 5-point scale. The forms also indicated that the teachers had observed applications of high school mathematics concepts during the visit. In selecting an adjective to describe their feelings about the visit, four teachers selected "excited," and two teachers selected "involved."

## Southern Regional Research Center Site Visit

The third collaborative-sponsored site visit was to the United States Department of Agriculture (U.S.D.A.) Southern Regional Research Center (SRRC) on March 30, 1989. SRRC is a U.S. government research lab that studies farm products grown in the area. The lab also researches the process by which fabric is made from cotton. As with last year, the site visit provided teachers with an opportunity to learn about the uses of mathematics in the U.S.D.A. with a specific emphasis on mathematical applications in food and textile research.

Ten teachers, including one science teacher, participated in the site visit. Participants rated the visit very high on both the usefulness of the information presented and on the observation of applications of concepts taught in high school mathematics. Almost all of the teachers rated these aspects a 4 or 5 on a 5-point scale. Asked to select an adjective that best described their feelings about the site visit, of the eight teachers that responded, seven selected "excited" and one selected "inquisitive." Comments on the written evaluation forms were also very favorable and included, "Scientists from this institution should give talks in school"; and "The visit was most beneficial."

## Freeport-McMoRan, Incorporated Site Visit

The fourth site visit, held April 25, 1989, was to Freeport-McMoRan, Incorporated, a company that had hosted a site visit the year before. Five teachers participated in the visit. Topics presented by the company's staff included the time value of money; the mathematics of accounting; tax reporting; business planning and reporting; and a model for shipping and scheduling.

### Shell Offshore, Incorporated Site Visit

On April 26, 1989, the New Orleans collaborative sponsored a site visit to Shell Offshore, Incorporated, which had hosted collaborative teachers the previous two years. Nine teachers participated in the visit. Topics addressed by the staff of Shell Offshore, Incorporated, included: "Production," "Well Design," "Reserve Determination," "Well Control," "Exploration," "Seismic Acquisition," "Data Processing," and "Seismic Interpretation for Exploration."

In general, the teachers were excited about the visit. On the written evaluation forms, the nine teachers reported that most of the information presented during the site visit was useful to them as classroom teachers. They also said that they observed many applications of mathematical topics during the visit. Asked to indicate the adjective that best described their feelings about the site visit, of the seven teachers who selected an adjective, four chose "excited," two chose "involved," and one selected "inquisitive." Comments from participants were very favorable, and included: "A great workshop! I enjoyed it very much" and "I enjoyed this site visit very much."

## Institutes and Seminars

### Woodrow Wilson Summer Institute on Geometry

From August 15-19, 1988, the New Orleans Mathematics Collaborative, in conjunction with the Orleans Parish Schools, sponsored a Woodrow Wilson National Fellowship Foundation Summer Institute on Geometry at the Center for Media and Technology. The Institute, which focused on introducing geometric concepts to students, was presented by four Master Teachers from New York, Chicago, Los Angeles and Denver, who had received training at Princeton University under the direction of the Woodrow Wilson Foundation.

During the week-long workshop, the participants had the opportunity to use hands-on materials such as geoboards, dot paper, polyominos, and origami to explore such diverse topics as co-ordinate geometry, spatial geometry, transformations, solid geometry, and plane geometry. At the conclusion of each afternoon session, teachers had the opportunity to work on computers using the software Geometric Supposer. The Institute concluded with a luncheon at the Pontchartrain Hotel, which was attended by Superintendent Williams. At the luncheon, the workshop leaders presented "gag" awards to teachers to commemorate memorable experiences that the teachers had had that week.

Institute enrollment was open to all mathematics teachers from the greater New Orleans area schools. The response was greater than anticipated. Although no stipend was offered, there was a waiting list of teachers and no dropouts. Twenty-one teachers, representing thirteen different schools, participated.

The Institute was extremely successful. Three of the teachers who attended wrote articles about the workshop for the NOMC newsletter. In one article, two teachers wrote, "This summer I had the opportunity to attend a Geometry Workshop. The program was presented by the Woodrow Wilson National Fellowship Foundation. It is one of the most interesting workshops I have attended. The four presenters, who were themselves school teachers from different parts of the country, had a wonderful way of presenting their subject matter. To call it interesting is an over-simplification; absorbing might be a better description of it." These teachers went on to report, "The week-long workshop was full of innovative hands-on ideas to introduce geometric concepts to students . . . . All of the teachers felt that the workshop was extremely beneficial and each of us plans to implement some of the ideas and concepts that we gained during the week."

Eight teachers who attended the Institute wrote comments on a questionnaire administered in February, 1989, to assess the impact of the Institute six months after it was presented. The questionnaire was administered by the Woodrow Wilson Foundation. Teachers' comments indicated that their enthusiasm for the experience remained strong. Three of the teachers described specific changes they had made because of the Institute. One teacher reported, "Because of the Institute, I have changed my approach to teaching geometry. It is more important to use models and also to let students construct some of the models." Another teacher reported that the Institute helped with planning and was adoptable to the level of students being taught. This teacher commented, " . . . . because many excellent ideas were modeled, I was able to select those techniques and materials that were suitable for the level that I instructed." A third teacher reported on the ideas presented: "It provided several new ideas and approaches for teaching concepts and for making the subject matter more interesting, meaningful, and enjoyable for the students."

## Mathematics/Science Anxiety Seminar

On Saturday, March 11, 1989, the Louisiana Science Centre, Shell Offshore, Incorporated, and the NOMC sponsored a workshop on helping students to overcome their anxieties about studying science and mathematics. Dr. Jeffrey Mallow, associate professor of physics at Loyola University in Chicago, presented techniques being used at the Science Anxiety Clinic at Loyola University and discussed their impact. Yolanda George and Walter Bogan of the American Association for the Advancement of Science in Washington, D.C. shared data collected by the association regarding equity issues in mathematics and science professions. They also demonstrated models that AAAS had developed to enrich classroom activities and to promote the scientific process. Approximately 100 mathematics and science teachers from the Orleans and Jefferson Parishes, including several collaborative teachers, attended the workshop. Since this was an activity in which the collaborative was a cooperating partner, the collaborative did not distribute evaluation forms.

## Industry Internship Program

The collaborative, in conjunction with Loyola University in New Orleans, initiated the Industry Internship Program during the 1987-88 school year. The program is designed to provide teachers an opportunity to work in a business atmosphere with the anticipation that they will return to the classroom with more creative skills, teaching techniques, and real-world applications. During the summer of 1988, two senior high school mathematics teachers worked as assistant statistical analysts in the sales and marketing department of the Port of New Orleans.

On August 17, 1988, R. L. Howard, President of Shell Offshore, Incorporated and Chair of the NOMC Steering Committee, hosted a breakfast meeting at One Shell Square to recognize the New Orleans Port Authority for implementing the Industry Internship Program and to thank the two teacher interns for participating. Chief executive officers and personnel directors from local corporations were invited to the meeting to discuss their participation in the Industry Internship Program.

Four local businesses have pledged a total of 11 internship positions for summer, 1989. The businesses are: Shell Offshore, Incorporated; Southern Regional Research Center; Freeport-McMoRan, Incorporated; and First National Bank of Commerce. The collaborative, in conjunction with Loyola University, is continuing to investigate the development of the academic coursework component of the program, which would focus on developing classroom materials. Participating teacher interns will be eligible for reduced tuition.

## Mathematics Curriculum Reform Luncheon

On May 19, 1989, the collaborative sponsored a luncheon meeting and discussion forum for community leaders on the topic: "What business, school administration and universities can do to support mathematics curriculum reform." Representatives of state and local government, higher education and business were invited to the event, which was held at the Plumsoll Club. In total, 29 people attended; they included five members of the MAC Education Fund, two members of the NOMC Steering Committee, four representatives from the New Orleans Parish Schools, two mathematics educators, ten members of the Supervisory Committee of the Ford Foundation's Middle Schools Mathematics Assessment Program, a documenter from the UMC project, and five staff members of the MAC Education Fund. The group represented a wide spectrum of the New Orleans community's education and business leadership, as well as national mathematics education leaders.

Dr. Mark Driscoll of EDC opened the discussion by outlining the nature of the current reforms in mathematics education. Three visiting mathematics educator/researchers, Ann McAloon, Mary Stokes and Carolyn Chestnutt-Thorsen, then elaborated on the points. Concluding remarks were made by Barbara McPhee, Jean Clement from the MAC Education Fund, and Allan Pitman from the UMC Documentation Project.

## Mini-Grant Program

The collaborative encouraged teachers to apply for mini-grants offered by the Metropolitan Area Committee (MAC) Education Fund. The MAC Education Fund, a project dedicated to encouraging community understanding of, support for, and commitment to quality public education in New Orleans, initiated its Mini-Grant Program to recognize the creative initiative of individual teachers and to invest in classroom projects which enhance learning opportunities for students.

Grants of approximately $500 are awarded to teachers on a competitive basis to support the creation and implementation of programs that enhance the textbook lessons. All New Orleans Public School teachers and instructional support staff are eligible to apply. Applications are due by July 7 of each year and awards are announced in the fall. Proposals are reviewed by the Mini-Grants for Teachers Committee, which is composed of representatives from academic, business, civic, labor, religious and school neighborhood communities.

To date, the program has awarded 132 grants to teachers and instructional support staff. In 1988, 95 applications were received and 35 were funded. During the 1988-89 school year, the NOMC awarded seven MAC Education Fund Mini-Grants to Orleans Parish Public School teachers for mathematics-related projects.

## End-of-the-Year Planning Meeting

The collaborative sponsored a gathering titled "Come, Relax, Share and Plan" for collaborative teachers from 5:30 to 7:30 p.m. on Thursday, June 8, 1989 on the rooftop of the Woodward Apartment Building. The meeting focused on issues of equity. A list of discussion questions was circulated with the invitation to the meeting. Seventeen teachers, representing nine schools, attended, along with the collaborative coordinator and director. The discussion centered on four topics: "Inequities as they are evidenced in your school"; "How do you work to create equity?"; "Challenges you confront as you address this issue"; and "The future of the collaborative and teacher involvement." Representatives to the UMC Teacher Leadership Conference, to be held in August, 1989, were asked to summarize teachers' input and present it at the conference.

## National and Regional Conferences

The collaborative budgeted $2,500 to fund teachers' attendance at national and regional conferences. Teachers who had not previously received support from the MAC Education Fund to attend a conference were given priority.

## Southwestern NCTM Regional Conference

The collaborative sponsored 15 teachers to attend the Southwestern Regional NCTM Conference in Baton Rouge, Louisiana, November 3-5, 1988. The teachers were reimbursed for registration fees and lodging and received up to $40 for travel. Substitute teachers were provided by the school district. Noted speakers at the conference included Chuck Allen, Lola May, Brother Neal Gordon, Mary Hatfield, Suzanne Mitchell and Mary Kay Corbett. All of the teachers reported that the meeting was valuable.

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The Teacher Advisory Council awarded grants to eight teachers to attend the NCTM Annual Meeting in Orlando, Florida, April 12-15, 1989. Each participant received $300 to offset the cost of registration fees, travel, and lodging. All eight teachers who applied for the travel grants met the guidelines established by the Teacher Advisory Council for receiving a grant.

The theme of the conference was "Vision for the World of School Mathematics." During the day, teachers participated in workshops, met and exchanged ideas with other teachers from across the country, and visited exhibits filled with useful, exciting instructional materials and information. Several of the teachers chose workshops that addressed the content of the NCTM Curriculum and Evaluation Standards and their applications at all levels. The use of calculators and computers also spurred healthy discussion among the participants.

In the evening, the teachers participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Curriculum and Teaching Program.

Teachers who attended the meeting were very positive about their experiences. Some of the teachers noted that they were able to view demonstrations of materials that they hoped to begin using. "The commercial displays by the various vendors gave me the opportunity to become familiar with the most current resource materials for mathematics on the market," wrote one attendee. This person went on to report implementing some of the ideas and recommending to his school the purchase of other materials. Some of the teachers were inspired by the release of the NCTM Curriculum and Evaluation Standards. One teacher reported, "I was especially motivated by the 'unveiling' of the Standards, and have been redirecting some of my focus accordingly." Others reported professional growth through being stimulated, acquiring new information, and being motivated to do more with computers and calculators.

### Collaborative Newsletter

The collaborative expanded the publication of the NOMC Newsletter from three issues during the 1987-88 school year to four during the 1988-89 school year. The newsletter, which is distributed to all secondary mathematics teachers in the New Orleans Public Schools, collaborative board members, MAC board members, business partners and school district administration, was initiated to keep teachers and the community informed about collaborative developments as well as to provide a forum through which teachers can express their ideas on effective teaching techniques. The newsletter reports on collaborative activities, offers commentary from teachers, provides articles on topics in mathematics, and includes a calendar of upcoming events. Each issue of the newsletter published during 1988-89 also included reprints of one or two NCTM position papers. Teachers were encouraged to duplicate the articles and to disseminate and discuss them.

The collaborative is working to establish a solid relationship with the Print Shop of the Parish School System, so that it will be able to set up and print the newsletter for the collaborative. The collaborative is also trying to encourage representatives of the business community to use the newsletter as a vehicle to express their views on mathematics education and on the collaborative in general.

## E. Observations

### Project Management

The management of the collaborative made major strides during the 1988-89 school year. After a year without a full-time director, the collaborative welcomed the talents and energy that Ms. Sawyer brought to the position. Prior to her July 1 appointment, Ms. Sawyer attended two conferences, one for education fund directors that was held in

Pittsburgh and one on mathematics education reform at the North Carolina School of Science and Mathematics. Having Ms. Sawyer on the staff to attend to organizational issues freed Dr. Boucree to devote more of her time to program issues and interaction with teachers.

Both of the collaborative's governing groups met more frequently during the 1988-89 school year than they had during 1987-88. The Steering Committee, which did not meet at all the previous year, met three times during 1988-89. The Teacher Advisory Council met four times compared to twice in 1987-88. The regular frequency of meetings can be attributed both to having a director to attend to details and the pressing need for the development of a permanence proposal. As a result of both groups working together, a clearer focus was developed of the direction to take.

A system of governance that includes both a Steering Committee and a Teacher Advisory Council provides for the active involvement of representatives from all sectors in collaborative planning. The standing subcommittees of the Steering Committee draw upon both the higher education and business communities, along with teachers and other school district personnel. The Teacher Advisory Council helps to increase the number of teachers who can participate in collaborative decision-making. The collaborative staff serves as the link between the two committees; thereby a structure has evolved in which the TAC does not provide input directly to the policy-making group, but rather works through the collaborative administration. This relationship will be changed, as articulated in the permanence proposal, by including two representatives of the Council on the Steering Committee. Another change is that both committees have essentially included volunteers who have remained involved as long as they wished to. The notion of collaboration inheres the fact that interested people become active. A disadvantage of this is that the Steering Committee members serve as individuals, rather than as representatives of organizations. The tenure of people serving on these groups will become more formal, with fixed terms of two years. This appears to be an important step in strengthening the base structure, but there is a question of how this "first generation" of participants will continue their relationship with the collaborative.

## Collaboration

The New Orleans Urban Mathematics Collaborative continues to receive solid support from business, higher education, and the school district, both in terms of monetary support and professional time. Teachers benefit from this new collegiality in that they have developed new insights into how mathematics is being used in the workplace, they have more frequent opportunities to attend professional meetings, and they have forums available in which to engage in discussions about issues they face.

The collaborative's organizational strategy, which involves an active Steering Committee comprised of representatives of both business and higher education, has worked well. The committee is chaired by the CEO of Shell Offshore, Incorporated. Another person from Shell Offshore, Incorporated chairs the Site Visits/Internship Subcommittee. A professor from the University of New Orleans chairs the Symposia Subcommittee. In addition to bringing their expertise to the activities of the collaborative, these individuals have provided access to their organizations. Despite a somewhat dormant year in 1987-88, during which time the collaborative experienced the process of filling the director's position, the collaborative has regained its momentum. In 1988-89, the Steering Committee met regularly, a series of site visits was offered, four businesses agreed to offer internships in 1989, and the collaborative sponsored two symposia in which people from higher education played an active role. Thus, as the collaborative reported in its permanence proposal, a foundation upon which to build is firmly in place.

As with many of the other collaboratives, New Orleans mathematics teachers report that the new collegiality among their peers and colleagues has been one of the most valuable impacts of the project. Asked about how the collaborative has helped to influence the forming of relationships with other mathematics teachers, a teacher responded, "...I find that we know each other better, we are closer, and we are more willing to help each other!" The interaction is not new for all of the teachers. Another teacher commented regarding the same question, "In my school, we always had a great working relationship between the mathematics teachers, but through the collaborative, I have been able to meet, discuss, and work with other mathematics teachers in the NOPS system."

The relationships that have formed between teachers and those from the other sectors have been dependent upon the teacher and the manner in which he/she became engaged in the collaborative. Those who have participated in site visits have reported improved understandings of how mathematics is used in business. The two teachers who were interns for the Port of Orleans in 1988 produced a statistical report that was very useful to the Port. These teachers in return gained some understanding of the value of statistics in the work place and knowledge of the operations of the Port. Teachers who attended the two symposia were able to interact with Dr. Arthur Powell from Rutgers University in December and with a vice chancellor and a mathematics professor from the University of New Orleans in May. Those teachers who serve on the Steering Committee and its subcommittees have the opportunity to interact with those from both business and higher education as the group plans collaborative programs. In this way, the collaborative serves as a vehicle that teachers can use to gain access to mathematicians from business and higher education.

Prior to the restructuring of the collaborative's organizational framework, the primary occasions for interaction among teachers and those from business and higher education have been the site visits and symposia; while these events allow some interchange of ideas, they do not foster meaningful dialogue. In October, a teacher responded to a question about forming relationships with those in business and higher education, "[Relationships have formed] with other mathematicians in business and industry to a limited amount--more exposure than serious relationship." Another teacher responded, ". . . not so much with business/industry and higher education." In March, 1989, a teacher noted that the site visit provided information on ways to expand the curriculum. Another teacher mentioned receiving sample problems and an increased awareness of concepts advanced students needed to understand. Neither described the visit as an opportunity for professional networking.

The symposia subcommittee has addressed this issue and changed its format to include discussion groups following the speaker's presentation. This is one mechanism by which the collaborative is creating opportunities for meaningful dialogue across sectors. The challenge in creating a communications network among the different sectors, one of the goals included in the permanence proposal, is to identify other means for this to occur while simultaneously expanding the number of mathematics teachers who are actively involved.

The collaborative continues to explore new ways it can build relationships with the larger community in New Orleans. In May it sponsored an issue-oriented meeting for community leaders. The collaborative took advantage of a meeting being held in New Orleans on the Middle Schools Mathematics Assessment Program to bring nationally recognized experts in to address its members. As a result, representatives of the New Orleans education and business communities heard about a national mathematics education reform movement from those at its forefront. It is through such events and opportunities that community support for the collaborative is expanded.

Another form of collaboration has occurred with the school district. The district has expressed its support by providing teachers with release time to attend site visits and conferences. It also is apparent in the personal attention the collaborative receives from the district superintendent, the associate superintendent, and the district mathematics supervisor, Ms. Louvinia Wallace. For example, Superintendent Williams attended a meeting of the Teacher Advisory Council to advise its members of a continuing education opportunity for teachers. The associate superintendent was active in developing and reviewing the permanence proposal.

### Professionalism

The collaborative continues to provide opportunities for teachers to attend professional meetings and conferences. These opportunities have been well received and have resulted in some changes in classroom practice by teachers. It should be noted, however, that there are on-going barriers that resist change in the professional growth of teachers; these include tradition, teachers' perceptions, and the system. In some New Orleans schools, particular courses become the domain of certain teachers, rather than all teachers teaching a range of mathematics courses. One teacher who has been teaching for over 15 years commented that for the first four years she taught basic mathematics; finally she went to the principal and was assigned to teach another class. She was not able to teach trigonometry until another teacher had retired and the assignment became available. In another school, one teacher assumes the responsibility of teaching the geometry classes and as such becomes the only geometry teacher. It appears that tradition, rather than expertise, dictates course assignments in some schools, thereby prohibiting some teachers from teaching a variety of courses.

Another barrier is teachers' misperceptions about the focus and scope of collaborative activities. When asked about their participation in the collaborative, some teachers commented that they perceived collaborative activities as not relevant to their students. One teacher, who is very active in the collaborative, perceived that the activities were directed toward those students on the upper or lower end, but not to her mid-level achievers, or to students who have the capability to learn, but have other issues such as low attendance or drug problems. Another teacher with 15 years experience who was teaching algebra reiterated the view that collaborative activities were directed more toward the upper-division courses. A third teacher who expressed some interest in serving on one of the collaborative committees would not initiate this involvement but would become involved if invited. It is difficult at this point to determine whether the root problem is, in truth, misperceptions about the collaborative or teachers' reluctance to participate. In either case, the comments of teachers indicate some restrictions in their relationship with the collaborative.

A third barrier is the system, which places certain constraints on teachers in general, and mathematics teachers specifically, in terms of what they can or cannot do in their classrooms. This is not a criticism of the district or schools, but a description of the restrictions placed on teachers' decisionmaking as a result of districtwide goals or priorities. In New Orleans, for example, there is very strong pressure to increase student test scores. As a result, at certain times during the year in some schools, one or two days of the week are spent preparing students to take the standardized test. One mathematics teacher uses old tests as worksheets to guide his students. Pressure for improved test scores is felt by principals, as some school board members have argued that a principal's salary should depend on student attendance and test scores. Another restriction the system places on teachers relates to their evaluation of students. Some teachers reported that they have been told that students cannot be given scores below 65 percent.

Limited resources is yet another problem confronting teachers. Asking about the key issues regarding mathematics education in the district, a teacher responded, "The key issues regarding mathematics education in my district are lack of money to implement changes and shortage of mathematics teachers. This affects the availability of purchasing books, attracting new teachers, and generally purchasing supplementary materials." Access to computers for mathematics classes is limited by the availability of computers. Eight computers were provided to each of the large high schools by the district in 1987-88, but these are used in the computer literacy classes, a district requirement for all students, and computer science courses.

The collaborative has responded to teachers' perceptions about institutional barriers by working to provide opportunities for professional development and support for innovation and reform. In 1988-89, 23 mathematics teachers received support to attend either the regional or national NCTM meetings. Some mathematics teachers have noted that while they had attended professional meetings prior to becoming involved in the collaborative, collaborative support has helped reduce the financial burden. As one teacher observed, "I was already involved in professional organizations but the NOMC has provided funds for me (and other teachers) to participate in more conferences that otherwise I would not have attended." Another teacher noted, "[The collaborative] has increased my active participation in NCTM."

Teachers' perceptions about the collaborative's effect on their working conditions have been mixed. When five teachers were asked about this, three of them indicated that there has been no change. One teacher responded, "I have become militant about professionalism, [however], the NOMC has not fostered any changes in my working conditions at this time." Of the two teachers who did note some changes, one reported receiving a computer and a graphing calculator and the other noted a change in awareness that teachers and students all over the world were having similar problems. The latter felt that knowing they were not isolated was extremely beneficial.

There is some evidence that mathematics teachers are not taking as much initiative as they have in the past. Seven mathematics teachers received mini-grants in 1988-89, compared to ten in 1986-87, which was the last time mini-grants were available. Forty-five teachers participated in site visits during 1988-89, compared with 69 in 1987-88; the total number who attended in 1988-89 is less than half the total number of those who could have participated. Mathematics teachers did not present any collaborative workshops in 1988-89, while in the previous year two teachers presented a workshop on the NCSSM materials. The Teacher Advisory Council did meet more frequently during the year and approximately the same number of teachers attended the symposia as in 1987-88. But in activities that required mathematics teachers to take the initiative, fewer teachers were involved. While this could be related to teachers' perception of the relevance of these activities, it is difficult to be certain about the reasons from the data available at this time.

Toward the end of the school year, the collaborative began to take steps to develop more leadership among teachers. This included actively involving teachers in developing the permanence proposal, sponsoring a leadership symposium in May, and holding a joint Steering Committee and Teacher Advisory Council meeting in June. At the Leadership Symposium, teachers discussed issues relating to equity and mathematics reform with an eye toward developing plans of action. It was agreed that teachers need time and opportunities to plan together; another group questioned how teachers could de-mystify mathematics for their students. The impact of this new focus on leadership is yet to be seen. What is important to note is that developing strong leadership among the mathematics teachers is one way of addressing the barriers of tradition, perceptions, and the system.

The collaborative is affecting the professional lives of mathematics teachers in New Orleans. When asked about the most significant change that could be attributed to the collaborative, teachers noted professional growth, a greater positive attitude toward teaching, and a change in their view of the role of a mathematics teacher. One teacher responded that the collaborative has contributed to "my attitude about my profession as a teacher of mathematics . . . . [The] role of mathematics teachers has changed and [I have a] responsibility to help define this role and not let others, who are not in the profession, do it for us." Questions facing the New Orleans Mathematics Collaborative, as well as other collaboratives, include how to keep the momentum going and how to generate more teacher ownership for the collaborative. The collaborative's efforts to enhance teacher leadership is a response to these questions.

**Mathematics Focus**

During 1988-89, the collaborative stressed the current reforms in mathematics education, and many of the year's activities touched on reform in one way or another. Dr. Powell, in the December symposium, stressed that mathematics is a way of thinking rather than a body of knowledge. At the spring symposium, teachers discussed issues of mathematics curriculum reform related to equity, including the time necessary for underprepared students and those who have psychological anxiety concerning mathematics to learn mathematics. The Woodrow Wilson Summer Institute on Geometry presented new models for teaching geometry. Reflecting on that experience, one teacher wrote, "I found that [the master teachers] don't emphasize formal proof in geometry, but stress justifying a case or example. I have found this way of proving much easier to teach and more practical." Also relative to reform and to the value of helping students learn mathematics in context, teachers have had the opportunity to gain knowledge on applications of mathematics through the site visits.

Teachers acknowledge that the collaborative has helped to increase their awareness of current trends in mathematics education and has made them aware of new approaches to teaching mathematics. All five teachers who were asked if the collaborative has increased their awareness of current trends in mathematics education responded in the affirmative. The teachers indicated that this increased awareness has come from a variety of sources, including the symposia, conferences, and the Woodrow Wilson Summer Institute on Geometry. Other teachers have affirmed the collaborative's role in their fresh perspectives on the mathematics curriculum. One teacher noted, "I view the mathematics curriculum differently in that I am now looking with more 'creative eyes.'" Another teacher reported, "As a result of the collaborative, I have a better sense of what I should teach, how I should teach it, and then how to evaluate my students." Other comments included, ". . . the collaborative has afforded me an opportunity to reach far beyond my goals and expectations"; "Instead of aiming for preparing a student to be eligible to enter college, I am now concerned with giving the student a background in mathematics such that [the student] can enter college, be successful, and make a choice of career options."

Thus the collaborative seems to be having some positive impact, in general, with at least some teachers. But there are some questions regarding how widespread is the support for current reforms and how the reforms have been put into practice. In some cases the problems that New Orleans mathematics teachers face are social and economic rather than pedagogical, calling into question the relevancy of the reform. In observing a class, a member of the UMC Documentation Project noted some basic issues that the mathematics teacher faced. In the sixth month of a geometry class a tenth-grade student, who occasionally attended class, could not (or would not) identify an angle in a figure of two intersecting lines drawn on the blackboard. After the class, the teacher noted that many of her students do not have the experiences, opportunities at home, or resources such as books that provide the context for learning some of the mathematical ideas. She described the difficulty in working with students who do not have such basic knowledge. She explained that the boy who could not identity the angle was a real problem student in the ninth grade. His mother came to school upset because she was unsure what to do. This year, the student has joined the basketball team and has attended class occasionally instead of not at all. Other students in the class were making good progress. This situation illustrates the range in mathematical knowledge that teachers must address and offers insights into the underprepared student.

A teacher of 24 years from another school believes that students need to memorize concepts before they can solve problems, that she needed to train her students' minds, and that using calculators will prohibit students from learning how to compute. This teacher's perception of teaching differs from current recommendations for mathematics education which emphasize the use of calculators and the importance of teaching students to construct their knowledge through experience. In contrast, a teacher at a third school has difficulty in understanding why teachers will prohibit their students from using calculators and how they can justify the stance that students who use calculators will not learn how to compute. This teacher viewed the algorithm for the division of fractions (invert and multiply) as mechanical as pushing a button on a calculator. These two teachers represent the spectrum of beliefs about mathematics and what mathematics is important for students to know that are held by at least some mathematics teachers in New Orleans. Collaborative efforts apparently have increased teachers' awareness of the current trends in mathematics education, but there remain differing points of view when it comes to practice.

The collaborative took additional steps during the year to provide activities that were relevant and responsive to the teachers' needs. One step was to incorporate discussion groups into the symposia format. In this way, teachers are afforded the opportunity to interact with one another and to relate the discussion topic to their specific situations. Another step is the conceptualization of peer support groups to be implemented in the 1989-90 school year. These groups have the potential to provide teachers with peer support and to help them to address the issues they are facing. It is hoped that these groups will foster teacher leadership, and will provide an opportunity for teachers to view each other teaching (through the use of video recording) and enable them to discuss their approaches with one another. One teacher, when asked if she had any interest in participating in such a group, said that she would like to talk with other teachers about ideas she could use in class. One caution in forming such groups is the potential of inbreeding practice that may not be compatible with current ideas in the field of mathematics education. This can be addressed by providing peer groups with sources for new ideas to discuss and adapt to their particular teaching situations.

## F. Next Steps

In 1989-90 the New Orleans Mathematics Collaborative will begin to implement the plans identified through its permanence planning process. During the summer of 1989, 11 teachers will work as interns in four local businesses. A Woodrow Wilson Summer Institute on Statistics will be held for New Orleans mathematics teachers August 14-18. Also in August, four teachers from the collaborative will attend the UMC Teacher Leadership Conference in Newton, Massachusetts.

During the 1989-90 school year, peer support groups will be established to provide assistance and services to teachers in regard to their instructional needs. One symposium is scheduled during the year, down from two that have been offered annually. Mini-grants will continued to be available through the MAC Education Funds.

The Teacher Advisory Council will be renamed the Teacher Leadership Council and will be charged with identifying topics for workshops. The Council also will be responsible for designing the guidelines and policies for allocating funds to support teachers' attendance at local, regional, and national conferences. Furthermore, this group will serve as a forum for teachers to discuss a wide variety of issues and to identify Council positions on these issues.

Efforts will be made during 1989-90 to increase the number of businesses that provide site visits and summer internships. A goal is to increase the number of businesses that are involved from six to a minimum of ten by 1993. After completing an internship, teachers will be encouraged to enroll in courses at Loyola University to design curriculum materials that will expand their internship experiences. Loyola offers reduced tuition fees for local teachers. The NOMC newsletter will continue to be published quarterly. Efforts will be made to increase the participation of the business community by having business people write articles for the newsletter.

# SUMMARY REPORT:
# PHILADELPHIA MATH SCIENCE COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Philadelphia Math Science Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Philadelphia Math Science Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the directors' meeting in Boston in February, 1988; the meeting of representatives of all of the projects in Philadelphia in October, 1988; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

# PHILADELPHIA MATH SCIENCE COLLABORATIVE

## A. Purpose

The primary purposes of the Philadelphia Math Science Collaborative are to promote teacher leadership and team building, and to contribute to a cohesive vision of mathematics teaching for the future. These activities are viewed as an initial step toward the goals of promoting change and empowering teachers to make needed changes.

The specific goals of the Philadelphia Math Science Collaborative are:

1. to develop, document, and evaluate the position of an in-school collaborator who would be responsible for fostering communication among teachers, even across disciplines, and for serving as a catalyst for innovation and change;

2. to increase teacher participation in extramural professional development programs that offer:

   a. partnerships between teachers and their colleagues in academia and industry;

   b. opportunities to enhance and improve teachers' knowledge, skills and professionalism; and

   c. new ideas and opportunities for mathematics instruction, including integration of mathematics and the sciences, and use of calculators and computers to teach mathematics and science.

## B. Context

The Philadelphia Math Science Collaborative operates within a major urban school district that is divided into seven administrative subdistricts. In sharp contrast to many of the other school districts in the UMC project, enrollment in Philadelphia's schools has decreased by about 25 percent over the past ten years. At the same time, the district's per-pupil expenditures have doubled. Of the total 200,000 students, 64 percent are black, 24 percent are white, 9 percent are Hispanic and 3 percent are Asian. Forty-seven percent of the students are from low-income families. Approximately 5,400 students in the district are Limited English Proficient (LEP). This group consists primarily of Hispanics, but a rising number of Asian immigrants is adding to the LEP population.

The student-teacher ratio over all grades in the Philadelphia school district is approximately 10:1. Fifty-nine percent of teachers are white, 39 percent are black and 1 percent are Hispanic. It is estimated that within five years, 40-60 percent of Philadelphia teachers will retire or will be eligible to retire. Many current vacancies have not been filled. A special program, the Teaching Opportunities Program for Students (TOPS), has been initiated to address a pressing shortage of minority teachers, whose ranks are declining while minority enrollments are rising. This program involves a partnership among the school district, Temple University and Provident National Bank.

Approximately 50,000 students attend Philadelphia high schools. Of these, 63 percent are black, 25 percent are white, 8 percent are Hispanic and 4 percent are Asian. Thirty-six percent of all high school students are from low-income families, and 12 percent drop out of school each year.

Twenty-one of the district's 33 high schools are considered comprehensive high schools and educate 77 percent of the city's high school students. These schools are characterized by high dropout rates, low student achievement and teacher burnout. In response to overcrowding in the 1960's and more recently to gang violence, ten Philadelphia high schools have shortened their school day by an hour and eliminated the student lunch period as a way of decreasing the amount of unscheduled time students have while on school grounds. Fifty-nine percent of the Hispanic students, 51 percent of the black students (81 percent of all minorities in the city) and 16 percent of the white students attend one of these ten high schools. Over 30 percent of the students in comprehensive high schools drop out of school before graduation.

Of the 1,900 high school teachers in the district, 57 percent are white, 42 percent are black and 1 percent are Hispanic. In the high schools, the student-teacher ratio is about 26:1. Less than one percent of the teachers who received certification in Pennsylvania in 1988 were black. Overall, 6.4 percent of the teachers in the state are black, while 13 percent of the students are black. Part of the problem is that only 57 percent of the state's black applicants passed the teacher certification test, compared to 93 percent of white applicants.

The large number of educational organizations operating in Philadelphia offers collaborative teachers a myriad of opportunities for professional enrichment. PATHS/PRISM: The Philadelphia Partnership for Education, which is the adjunct administrative organization for the collaborative, is a program of the Committee to Support Philadelphia Public Schools that represents colleges and universities, foundations, and corporations in partnership with the School District of Philadelphia. The program, under the direction of executive director Judith Hodgson Renyi, claims to be the country's largest, most comprehensive public/private partnership for curriculum and staff development. PRISM, Philadelphia Renaissance in Science and Mathematics, is a component of PATH/PRISM designed to assist teachers in the School District of Philadelphia in strengthening the effectiveness of instruction in mathematics and science. PRISM is directed by Dr. Fred Stein.

During the 1988-89 school year, the Philadelphia Math Science Collaborative (PMSC) focused its efforts on teachers in 13 target high schools, representing five of the seven administrative subdistricts in the city. Approximately 21,000 students, representing 14 percent of the total population in the five subdistricts, attended one of the collaborative's 13 target schools during the 1987-88 school year. Seventy-six percent of these students were black, 11 percent were white, 10 percent were Hispanic, 3 percent were Asian and less than 1 percent were of other ethnic origins. Forty-three percent were from low-income families. Sixty-seven percent of the students in the target schools were enrolled in mathematics, but only 46 percent of the total received credit for mathematics for the 1987-88 school year. In 1987, SAT scores for the 1,064 students in collaborative schools averaged 336 in verbal aptitude and 376 in mathematics aptitude, compared with state averages of 428 and 463, and national averages of 430 and 476, respectively. Twenty-three percent of the students in the 13 target schools were retained in grade for the 1987-88 school year. The annual dropout rate across all PMSC schools in 1987-88 was approximately 15 percent.

Of the approximately 1,240 teachers in the 13 target schools in 1987-88, 62 percent were white, 36 percent were black, and 1 percent were of other ethnic groups. Thirty percent of the 200 mathematics teachers employed by the target schools are members of a minority group.

The percentage of Philadelphia students in grades 1-8 who score at or above the national norms on standardized tests is increasing. In 1989, 53 percent scored above the 50th percentile in mathematics concepts (compared to 34 percent in 1984); 54 percent scored above the national median in mathematics computation (compared to 36 percent in 1984); and 38 percent scored above the national norms in Reading and English (34 percent in 1984). Students were tested using the California Test of Basic Skills (CTBS, McGraw-Hill) that was adapted for Philadelphia as a criterion-referenced test with national norms.

It is anticipated that approximately 30,000 youngsters will attend summer school in 1989, the greatest number ever. At least 2,000 of these students will attend enrichment rather than remedial programs. Consequently, more teachers planned to teach summer school and will not be available to take advantage of summer professional development opportunities.

More than 50,000 children in Philadelphia are "latch-key" children, those with no adult supervision while their parents are at work. The City Council reported that 25,000 children could be cared for in school-based programs for a total cost of about $1 million, assuming that space or other facilities were donated. With the average cost of full-time child care in Philadelphia about $4,900 per year and the modal income for single mothers currently at less than $10,000, federal or state aid will be needed to help alleviate the problem.

In 1988, George Weiss, a millionaire real estate investor, offered to pay for the college educations of 112 West Philadelphia 6th graders if they stayed away from drugs and graduated from high school. As part of this effort, the Weisses are financing efforts to establish a small alternative high school program on or near the University of Pennsylvania, George Weiss' alma mater. The university has agreed to make physical resources and faculty available to both students and teachers in the alternative program. The Weisses envision a collaboration between the university and their efforts to help students succeed, which could provide a model for improving the education of inner-city students nationwide. Approximately half of the students eligible to benefit from the college scholarship program will attend the alternate high school.

In May, 1988, the Philadelphia Federation of Teachers and the School Board completed negotiations on a new four-year teachers' contract that went into effect in September, 1988. The agreement included both a longer school week and year. In addition, the number of hours teachers are allowed to spend in staff development and department meetings has been limited to approximately 20 hours per year. As a result, there will be no more district-wide curriculum committee meetings. Furthermore, department meetings and staff development sessions can no longer be held during regular school hours.

Salary increases included in the contract will make Philadelphia teachers among the highest paid urban school teachers in the nation. Teachers will receive $900 plus a 4 percent increase the first year, a 4 percent increase the second year, a 5 percent increase the third year, and a 6 percent increase the fourth year. With the new pay increases, a beginning teacher with a bachelor's degree will earn a starting salary of $20,000. To help fund the contract, both the teachers' union and the School Board went to the City Council in support of a tax increase; the Council voted it down. While the School Board will have no trouble financing the new contract in 1988-89 (a surplus of $47 million is expected), the Council's decision not to raise taxes has the potential of creating serious financial problems in the coming years. Without new taxes or other sources of revenue, the district could have a deficit of $427 million by 1993. The projected budget for the 1989-90 school year is approximately $1.1 billion (up from $954 million in 1988-89). A large portion of the budget is targeted towards the estimated $60 million needed for asbestos cleanup in the city's schools. More than half of the district's school buildings were built before 1940, and most need substantial repairs and renovations.

The School Board voted to extend Superintendent of Schools Dr. Constance Clayton's contract through 1990 and raised her salary to approximately $100,000 per year. Dr. Clayton plans to reorganize the city's comprehensive high schools. Many educators think of these schools as merely holding pens for the least-motivated and least-successful inner-city students.

New legislation is targeted at attracting and retaining teachers in the inner-city schools. Merit pay may be used as incentive to curb teacher burnout. Governor Casey signed into law the Urban and Rural Teacher Loan Forgiveness Act, which provides up to $2,500 per year to a maximum of $10,000 total of forgiveness of Guaranteed Student

Loans obtained through the Pennsylvania Higher Education Assistance Agency. Teachers who serve in designated inner-city schools will be eligible for the program.

In an effort to reduce the school district's administrative staff without resorting to forced layoffs, the Board of Education passed a retirement incentive plan. Principals and other administrators with at least 25 years of continuous service or 30 years total service can retire with increased termination pay, the opportunity to continue medical benefits, and better compensation for unused sick days. The action occurred in response to the City Council's ruling on taxes. Nearly half of the district's 414 principals and vice principals are eligible to apply for the plan. However, the district is limiting to 50 the number of early retirees whose positions are not eliminated due to budget cuts. All administrators whose positions are eliminated and who are not offered another position at comparable pay also will be eligible.

As part of the reorganization of administrative positions planned for summer of 1989, 19 new positions were created, and 51 jobs were eliminated. This consolidation is expected to save the district $1.5 million each year. Twenty-five administrators, including 11 principals and six vice principals, decided to retire under the incentive plan. The biggest impact of the reorganization will occur in the curriculum department. Most of its central office personnel will be eliminated or reassigned to give teachers and principals more leeway to adapt curricula to their schools' individual needs. Individual divisions of mathematics education, science, and other content areas are being consolidated into a unified office of curriculum. In addition, 26 principals from elementary and middle schools in the district are being reassigned to new schools, and ten others will be placed in special assignments. This action, initiated by Superintendent Clayton, is designed to match the personal strengths of principals to the needs of individual schools.

The School District of Philadelphia is promoting high school coursework that stresses the interdependence of mathematics and science: for example, district money was available to support joint curriculum projects. Teachers have been encouraged to integrate concepts from science and mathematics so that students see the logic and interdependence of the scientific fields. As a result of this focus, the district has developed a new Algebra course designed for students who may have trouble with the traditional Algebra I course. The new course will cover the same material as Algebra I, but over a two-year period. Additional courses are being developed to reflect the thrust of the new NCTM Standards.

Pew Memorial Trusts has granted the Philadelphia public school system $8.3 million in order to revamp its comprehensive schools. The Philadelphia Schools Collaborative, an independent 501(c)3 nonprofit corporation, was established as grant manager and it will coordinate efforts between schools, establish research and evaluation, and funnel monies into the high schools for approved purposes. The success of the project depends upon the notion that educational reform comes primarily from teachers. Radical approaches to teaching are supported. Mainstreaming of special education students is planned. Schools-within-schools are encouraged. Their increased autonomy has engendered excitement and enthusiasm among teachers.

A new program, funded by the Private Industry Council, is geared specifically to Hispanic youth who have dropped out of school. Called "Abriendo Caminos," or "Opening Roads," the program serves 57 students, helping them acquire the GED, and a job or job training.

The state of Pennsylvania has allocated $5 million in School Performance Incentive Awards to schools that have been successful in keeping students in school, raising their test scores and preparing them for college. Award criteria include raising test scores by at least 10 percentage points, reducing the dropout rate by at least 1.8 percent, and improving preparation for college by increasing both the number of high school seniors taking the SAT and the scores over the previous year. Seventeen schools in Philadelphia will receive $581,000, which is nearly 12 percent of the total monies awarded across the state.

## Professional Opportunities for Teachers

PATHS/PRISM offers mini-grants of $300 to fund an individual teacher's school-based project, and collaborative grants of $3,000 for a team of two or more teachers working together with resource people from area universities, scientific and cultural institutions, and corporations to develop innovative curriculum in the arts, humanities, mathematics and science. During 1989-90, The Philadelphia Federation of Teachers will contribute $50,000 to PATHS/PRISM to support grants for district teachers and schools. The district has agreed to provide matching funds to support the grants program, which has been a major source of research and a catalyst for the development of new ideas in teaching.

PATHS/PRISM also sponsors monthly colloquia throughout the academic year, presented by teachers who work as a team with university, college, and museum faculty. For example, the colloquium "The History of Mathematics" was offered November 30, 1988; "Language and Mathematics" was presented by Joan Countryman, department head of Germantown Friends School, on January 17, 1989; and a third colloquium during the year was led by collaborative teacher Ms. Nancy Byline.

PRISM recently received a $700,000 grant from the NSF to train 152 middle school teachers to employ a thematic approach in teaching. The program's goal is to train instructors to teach mathematics and science emphasizing inquiry and creative problem-solving. The grant is one of the largest single program grants ever awarded by the NSF.

At the request of the Math and Science Teacher Advisory Group, PRISM and the School District of Philadelphia have organized several teacher-to-teacher professional development workshops in science, computer education and mathematics. Twenty-one topics are being funded involving nearly 400 middle and high school teachers. Workshop topics include computer applications, ecosystems, life science, algebraic software, geometry, graphs and charts across the curriculum, mathematics across the curriculum, thinking skills in the scientific process and using base-10 blocks. At the workshops, teachers will review strategies and receive materials to help them implement new ideas in their classrooms.

In addition to working with the Philadelphia Math Science Collaborative, PRISM operates a number of its own programs. The Elementary Science Kits Program, developed in cooperation with the School District of Philadelphia and the Franklin Institute Science Museum, distributes science kits to 24,000 fifth and sixth grade students to provide them with year-long, hands-on materials to carry out scientific investigations. Kits are currently being pilot tested in third and fourth grades. The Light, Heat, and Motion program is a three-year project, initiated in the summer of 1988, to provide elementary and middle school teachers opportunities to participate in summer institutes and academic-year programs focusing on light, heat, and motion. The Science Teacher Enrichment Program (STEP) focuses on staff development for secondary school biology, chemistry, and physic teachers in the comprehensive high schools. As part of the STEP program, teams of teachers from 20 high schools attended five-week graduate courses given by the University of Pennsylvania.

PRISM Project for Mathematics Manipulatives ($P^2M^2$) conducted 1988 summer workshops for middle school teachers on critical thinking and use of manipulatives. During the school year a committee of teachers and the director of mathematics developed hands-on materials to facilitate the integration of mathematics across the curriculum. PRIME serves 3,000 students annually in its efforts to increase the enrollment of minority students in upper-level courses in science and mathematics. Philadelphia Teachers in Industry Program (PTIP) is a year-long program that enables science and mathematics teachers to become involved in the latest corporate-based applications of science and mathematics and to bring this knowledge back to their classrooms. The PTIP fellows work full time in area corporations during the summer and then share their knowledge and experiences with students, colleagues, and counselors during the school year.

PRISM helped to establish two professional teachers' organizations and continues to provide support through membership dues. The Philadelphia Area Elementary Science Teachers Association (PAESTA) and the Philadelphia Secondary Science Teachers Association (PSST) provide teachers with opportunities for professional interaction and assistance in organizing pilot programs. In addition to these, PRISM administrates two one-week institutes each summer, one in chemistry and one in mathematics, at Beaver College. The institutes are co-sponsored by the Woodrow Wilson National Fellowship Foundation and are open to all teachers. PRISM provides a stipend to participants from the School District of Philadelphia.

PRIME is a project originated by a grant from General Electric and organized by Drexel University and the school district. The program targets minority students from 33 schools in the Philadelphia area. Business sponsors adopt one or more of the participating schools, and students are expected to do college equivalent work and are introduced to role models and real-life technical and engineering situations. Students also get a chance to develop a product from their own design. The program has influenced the majority of its participants to go on to higher education.

NSF is sponsoring Project EXCELS (Expansion of Computer Education in Learning the Sciences), at Indiana University of Pennsylvania during the summer of 1989. The mathematics portion of the program will immerse teachers in three weeks of intensive training in the use of computing technology in the mathematics classroom. Each participant receives a stipend of $600, room and board, project-supported software, a computer provided by the district for classroom use, and $2,000 of commercial software. In addition, all participants receive three graduate credits. Teachers applied during the spring of 1989 and six collaborative teachers were among those selected to attend.

Philadelphia has been selected by the American Association for the Advancement of Science (AAAS) to be one of the test sites for the 2061 Project, a massive overhaul of the science and technology curriculum. The $8 million to $10 million project is being underwritten by the Carnegie Corporation, the Mellon Foundation, IBM and NSF. The School District of Philadelphia is also providing funds, and IBM is donating more than $250,000 in hardware to the Philadelphia site alone. Dr. Fred Stein, Director of PRISM, is project facilitator for the Philadelphia component of this national project to develop a science curriculum for all American schools. Several collaborative teachers are among the 25 teachers and administrators from Philadelphia who are assisting with the project. They include two representatives from Carver High School of Engineering and Science, one teacher from West Philadelphia High School, one from George Washington High School, and four from University City High School. Teachers from Audenried High School will also be involved in this effort.

## C. Development of the Collaborative

In 1988-89, four additional high schools enrolled in the collaborative, bringing the total number of target schools to 13: Overbrook, West Philadelphia, Martin Luther King, Roxborough, Edison, and Dobbins AVT (joined in 1986-87); South Philadelphia, William Penn, and Carver High School of Engineering and Science (joined in 1987-88); Gratz, Bok AVT, Germantown, and Kensington (joined in 1988-89). High schools must apply to become a targeted school; it is required that both the science and the mathematics departments be interested. In the past, the principal had to agree that there would be five joint science-mathematics department meetings during the year, but this requirement was rescinded during the past school year because of the new district policy that reduced the number of hours departments could meet each month.

Collaborative Director Dr. Wayne Ransom is also Vice President for Education for the Franklin Institute. Dr. Ransom has directed the collaborative since its inception, when the Franklin Institute became the funding agent in 1985. Ms. Sue Stetzer, a mathematics department head on special assignment to the collaborative, has been the collaborative coordinator since 1986. Ms. Joyce Neff, a mathematics teacher at University City High School, continues to serve as the collaborative's on-site observer.

The 1988-89 school year marked the beginning of the transfer of the administration of the collaborative from the Franklin Institute to PRISM. To facilitate the transition, Emily Meyers, a program coordinator for PRISM, shadowed Sue Stetzer during the year, attending most of the collaborative meetings and activities, to learn more about the position of coordinator. Similarly, PRISM Director Dr. Fred Stein attended the Steering Committee meetings and some other activities in the process of becoming the co-director of the collaborative with Wayne Ransom in 1989-90 and the director of the collaborative in 1990-91.

The Steering Committee and the Program Planning Committee are the primary structures for collaborative governance and planning. The Communications Committee had been formed during the 1987-88 school year to address issues of communication among mathematics and science teachers and among their constituent groups, and to coordinate the information included in newsletters and other publications distributed to the teachers by area organizations. In actuality, the committee served more as a network of people involved in writing newsletters than as a forum to address communication needs of the collaborative. At its only meeting of the year, January 26, 1989, the group decided to disband because its function could be served in other ways.

Other related teacher groups met during the year. A group of teachers formed the Teacher Leadership Planning Group and met three times to address the development of teacher leadership in the collaborative and in the district. Although the PRISM Teacher Advisory Group (TAG) is not directly related to the UMC project, some of its members are collaborative teachers.

## Steering Committee

The Steering Committee continued to include 14 members: two teacher representatives from targeted high schools; three representatives from the district administration (Director of Science, Director of Mathematics, and Director of Computer Science and Technology); two representatives of higher education; two representatives from business and industry; the director of PRIME; the director of PRISM; the collaborative director and coordinator; and the on-site observer. The committee held five bi-monthly meetings during the 1988-89 school year. Attendance at these meetings ranged from eight to 11 members. At its meetings, the Steering Committee reviewed recent collaborative activities and discussed a variety of issues, including the transition of the responsibility for collaborative administration from the Franklin Institute to PRISM; recognition of teachers; development of teacher leadership; release time for teachers to attend regional meetings in December, 1989; and the Technology Conference. At the December meeting, the members reached a consensus that teachers should be recognized for their efforts, but agreed that it was inappropriate to pay them even a modest stipend because of the competition this may cause with events sponsored by the Division of Mathematics and Science. At the April meeting, the committee recommended that the Steering Committee be continued and suggested that membership be rotated in order to bring in new people.

## Program Planning Committee

At the beginning of the year, the membership of the Program Planning Committee was comprised of 22 members and the collaborative coordinator: 15 teacher representatives from the 13 targeted high schools; four representatives of higher education; one district staff member from the science office; one from PRISM, and one from the office of computer science and technology. In March, three members of the defunct Communications Committee began to attend the meetings of the Program Planning Committee.

The Program Planning Committee met four times over the course of the year, during the months the Steering Committee did not meet. Attendance at the meetings ranged from 7 to 16, with an average attendance of 12 members. Topics of discussion included past and future collaborative activities, as well as many of the same issues addressed by the Steering Committee. At its March meeting, the group agreed to request that the district administration release a significant percentage of mathematics and science teachers to attend the NCTM and NSTA regional meetings in December, 1989. They also proposed that the collaborative provide financial support to teachers from target schools to attend these meetings. At its May meeting, the Program Planning Committee reviewed the selection criteria for target schools, considering the distinction between comprehensive high schools and non-comprehensive schools, and the high school restructuring program. It was decided that six of the seven new target schools for 1989-90 should be comprehensive high schools.

**Teacher Leadership Planning Group**

The Philadelphia Math Science Collaborative's initial focus involved empowering and increasing the professionalism of teachers; it has been successful thus far in providing opportunities for teachers to expand their professional horizons. The transfer of the collaborative from the Franklin Institute to PRISM highlighted the need to strengthen teacher leadership to ensure that teachers have a voice in future collaborative decisions. On Monday, November 28, 1989, 32 teachers representing 15 schools met at Williamson's restaurant for a "Teacher Empowerment" dinner meeting to discuss teacher leadership within the collaborative. Dr. Fred Stein and Ms. Emily Meyer attended as representatives of PRISM. Dr. Mark Driscoll, Director of the Technical Assistance Project at Education Development Center, directed the groups' efforts to prioritize those services and effects teachers value most about the collaborative. High on the list were networking opportunities, professional encouragement, PEGs, the newsletter, and opportunities such as the Technology Conference. Dr. Driscoll invited interested teachers to form a subcommittee to generate a proposal to EDC for assistance and support in addressing the issue of teacher leadership.

As an outgrowth of the meeting, PRISM formed a subcommittee of its Teacher Advisory Group to examine the issue of paying teachers for the time they devoted to serving as both presenters and participants of in-service programs. A copy of a memo from Dr. Driscoll regarding a teacher leadership conference to be held in August, 1989, was sent to all the teachers who attended the dinner meeting, accompanied by a letter from the collaborative coordinator outlining the meeting agenda. The letter invited interested teachers to attend a follow-up meeting on February 25.

Fourteen people, including nine teachers, two PRISM staff, two representatives from EDC, and Collaborative Coordinator Sue Stetzer attended the February 25 follow-up meeting. The five-hour luncheon meeting, which was held at the Adam's Mark Hotel, included a discussion of short- and long-term visions for the collaborative, the process for implementing these visions, leadership roles, and the barriers to change and leadership initiative. Teachers expressed mixed reactions to the meeting. Some felt the meeting was very interesting and a positive experience, while others expressed uncertainty as to what the meeting had accomplished.

A second meeting was held April 6 at the Franklin Institute. This meeting was attended by ten people--eight teachers, Sue Stetzer, and Emily Meyers. The letter that announced this meeting also named the three mathematics teachers who had volunteered to represent the collaborative at the UMC Teacher Leadership Conference sponsored by EDC in August. One science teacher had also volunteered to attend, but was not selected. The teachers continued their discussion from earlier meetings and outlined a plan for developing teacher leadership. As an outcome of this meeting, a proposal for the development of teacher leadership was written and submitted to EDC. The goals specified in the proposal were: increasing communication among teachers, both within and between mathematics and science departments; encouraging teachers to attend professional meetings; and increasing teacher participation in collaborative management. The proposal requested funding of $3,200, $200 for each of 16 potential collaborative schools. The funding is to be used jointly by members of the mathematics and science departments at the discretion of the teachers to facilitate teachers' sharing the information and ideas they have derived from their participation in conferences.

### PRISM Teachers Advisory Group

The PRISM Teachers Advisory Group (TAG) is comprised of mathematics and science teachers who meet regularly with the PRISM staff to discuss collaboration opportunities and issues relating to curriculum and staff development, and to form subcommittees to help launch new PRISM programs. Several teachers from the Math Science Collaborative are members of the Teachers Advisory Group. TAG subcommittees include one on the use of manipulatives and another on contests called the Academic Coaching Committee. As noted above, because of the discussion at the Teacher Leadership dinner, a sub-committee for TAG was formed at its November 29 meeting to study paying teachers for serving as presenters.

## D. Project Activities

The Philadelphia Math Science Collaborative exerts a concerted effort to increase teacher participation in the numerous professional development opportunities available in the Philadelphia area. During the 1988-89 school year, the collaborative publicized and encouraged secondary mathematics and science teachers to attend a variety of programs, including the PRISM and Woodrow Wilson Foundation Chemistry and Mathematics Summer Institutes at Beaver College, August 8-12, 1988; the Mathematics Colloquia Series co-sponsored by the School District of Philadelphia and Beaver College;

the ATMOPAV fall and winter conferences and spring banquet; the fall dinner meeting of the Philadelphia Secondary Science Teachers, October 13, 1988; PATHS/PRISM Colloquium Series at Temple University; the Mathematics Colloquium Series at Philosophical Hall, sponsored by PRISM; meetings of the Philadelphia Secondary Science Teachers Association (PSST) and of the Pennsylvania Council of Teachers of Mathematics (PCTM); a trip to a Fusion Laboratory at Princeton on November 5, 1988, sponsored by The Continuing Education Task Force of the Energy Education Advisory Council; the Third Annual Teacher Overnight Science Program at the Franklin Institute on November 18, 1988; "A Day for High School Mathematics Teachers," December 3, 1988, sponsored by the Wharton Business School of the University of Pennsylvania; LEGO LOGO Workshop, sponsored by St. Joseph's University and LEGO Educational Products, January 23, 1989; Engineering Week Committee Science and Mathematics Teachers Workshop, February 23, 1989, at Temple University; the PRISM Secondary Teacher Enrichment Program; the PRISM Science Curriculum Forum, April 13 and 27, 1989; the PRISM Mathematics Curriculum Forum, April 6 and May 11, 1989, and the Hypercard in Education Forum, May 17, 1989, sponsored by the Rosemont Graduate Faculty in Microcomputing in Education.

### Mathematics, Science, and Technology Conference

The Philadelphia Math Science Collaborative and the Divisions of Mathematics, Science, and Computer Science and Technology of the School District of Philadelphia co-sponsored the Mathematics, Science, and Technology conference from 8:30 a.m. to 2:30 p.m. September 24, 1989, at the Carver High School of Engineering and Science. All Philadelphia mathematics and science teachers were invited to attend the free conference, which included a complimentary coffee break and lunch. The collaborative served as a catalyst to bring the three divisions together to sponsor the conference, which was, in fact, an outgrowth of a collaborative-sponsored dinner meeting of science and mathematics educators at which discussion focused on promoting the integration of mathematics, science, and technology.

James Rafferty, chairman of Cricket Software and one of the foremost graphics software developers in the country, was keynote speaker. The 240 teachers and administrators in attendance participated in three 75-minute workshops presented by teachers and other school district personnel, as well as by collaborative staff. Participants preregistered for the workshops, choosing from among 27 different sessions, including "Appleworks for Science and Math"; "Lego TC Logo"; "Leadership Needed to Enhance the Use of Technology in Your School"; "Geometric Pre-Supposer"; "Pre-Calculus and Trig Software, Learning Grantsmanship"; "HyperCard" and "Telecommunications with the Apple II." At many of the sessions, teachers received software to use with their students.

Teachers were extremely enthusiastic about the conference and their comments on the evaluation forms were very favorable: "Have this conference at least twice a year!!! Others should be given a chance to go through this very enriching experience"; "A well thought-out approach to staff development. The amenities made participants feel appreciated. Everyone I spoke to is looking forward to further conferences. This is in direct contrast to the past required staff development days we've been faced to endure"; "Please do another one. Even if the workshops did not change, there would still be plenty of good, valuable workshops that I could attend"; and "This was a tremendous first step and a class act. What's next? How soon? Can I help?"

When asked what they liked best about the conference, teachers' responses included: "Spirit of togetherness and awareness of computer technology now for schools"; "Great selection of workshops. Wonderful chance to take advantage of the tremendous knowledge and talent within our school system"; "Chance to see a large variety of software. People who have concrete plans to classroom problems everywhere"; "The best parts were the gifts of software and the superb teaching tips from classroom teachers"; and "Sharing of information, meeting colleagues in the same area, the helpful hints and materials from the workshops." In response to the enthusiasm generated by the conference, the collaborative decided to sponsor monthly meetings of software users - groups.

## Monthly Meetings of Software Users Groups

Beginning in November, 1989, the collaborative sponsored a monthly series of after-school hands-on workshops on software appropriate to the curriculum. The meetings, which were held at the Philadelphia College of Textile and Science and open to all Philadelphia high school teachers, were publicized in the collaborative newsletter as well as through flyers sent to all mathematics and science departments.

## LOGO and Problem Solving

The first software users-group meeting was held November 15, 1988. Dr. Purnima Banerji, M. G. Mentor at Lincoln High School and a member of the Program Planning Committee, conducted a hands-on workshop on LOGO and Problem Solving. The workshop was designed to show teachers how to develop problem-solving skills using programming in LOGO. Among the problem-solving skills highlighted were identifying a pattern, guessing and testing, and representation of data. Specially designed worksheets that had already been tested in Mathematics in Applications classes at Lincoln High School were demonstrated.

While only five collaborative teachers and the collaborative coordinator attended the workshop, the on-site observer reported that the workshop was very good, and that everyone enjoyed the hands-on learning session. She observed, "Those of us who came all seemed to go out with enough information to try out the program at our schools."

## Problem-Solving Software for General Mathematics

The second software users-group meeting, held December 15, featured hands-on experience with software programs The Factory and Blockers and Finders. Both programs are designed to help develop problem-solving strategies. The workshop was led by collaborative teacher E. Y. Murphey and Collaborative Coordinator Sue Stetzer.

The eight teachers who participated in the workshop seemed to feel that the session was very useful. One teacher commented, "I came to find out about both programs. We have money to spend and I wanted to evaluate them. From the looks of things, I will order both." Another teacher said, "I really enjoy interacting with the other teachers. The information gained is not only from the presentation but from the teachers who are using these programs in their classrooms." Another added, "I have enjoyed these workshops given by the collaborative and look forward to more of the same. The presenters have all shown material that can be used in the classroom and have been used successfully." The on-site observer reported, "This has become a regular feature of the collaborative. Those attending have learned something useful to use in the classroom. They all seem to enjoy the workshops and the networking with other teachers."

## Graphing Software

The collaborative sponsored a software users-group session on graphing software, presented by Scott Steketee, on Thursday, January 12, 1989. Mr. Steketee, author of the function and graphing program, Super Plot, demonstrated the latest features in the newest version of the program. He also demonstrated Time Out Graph, a Beagle Brothers program that can graph data from Apple Works spreadsheets, and contrasted the program with Super Plot.

Twenty-six teachers and the collaborative coordinator attended the session, the largest turnout of participants for a monthly users-group meeting. Each teacher who brought an original Super Plot disk to the meeting received a complimentary updated disk.

The on-site observer reported that everyone enjoyed the presentation as well as the opportunity for networking. One teacher commented, "I felt most positive. It was interesting to see who came. I felt a real sense of community of sharing. The talent within the room impressed me. Scott's purpose in developing software is to improve teaching. I liked the fact that he showed Apple Works Time Out also." Another added, "It was wonderful. I had not used Super Plot before and wanted to. Now I will go home and play with it and prepare to use it in my class. I'm most enthused." A third teacher said, "I enjoyed it. I was looking for what was different from what I was using . . . ."

## Geometric Supposer

The user-group meeting February 16, 1989, focused on the use of the Geometric Supposer, a software package that enables students to construct and measure geometric figures. The workshop, which was led by collaborative teachers Phyllis Stickney and Pat Potoemy, was videotaped by students from Carver High School of Engineering and Science. The videotape is available to all collaborative schools.

Only five teachers and the collaborative coordinator attended the session, which was fewer participants than had been anticipated. The on-site observer reported that those teachers who attended enjoyed the program. One teacher commented, "I wanted to see how teachers are using the Supposer in their rooms." Another added, "I liked it so much, I'd like to do more." A third teacher said, "I wanted to know more about the Supposer. I have the program and I want to see how it is used in these two schools."

## Geometry Software

At the March 30 software session, collaborative teacher Tom Scott demonstrated Broderbrund's Geometry software for the Apple II GS. The software is a blend of tutorial material and interactive animation that allows the student to experiment with the basic concepts of geometry. The collaborative had ordered a lab pack of the software and, following the workshop, the software was available for loan to geometry teachers who had the requisite hardware.

Five teachers and coordinator Sue Stetzer participated in the hands-on workshop. The teachers' reactions to the software were mixed: One said, "I'm really glad I stopped in to see this. It could be useful." Another remarked, "I'm not terribly impressed. I don't think I could use my book money for this." A third commented, "This could be useful. It is interesting," and a fourth said, "I appreciate the opportunity to see and use this." The on-site observer reported, "We all were busy trying the software. It was generally felt that this [software] was no Supposer but if a student had been out for a long period of time and needed individual time to catch up, this might fill the need."

## Telecommunications

The last software users-group session for the school year was held April 28, 1989. The session, which was conducted by mathematics teacher Paul Hampel, focused on how to use telecommunications to access a commercial data base for student research and demonstrated how the Dow Jones News Retrieval Service could be used for on-line research. Mr. Hampel, who supervises two student-operated bulletin boards, also discussed the telecommunications course he teaches at George Washington High School and demonstrated two student-operated bulletin boards.

Seven collaborative teachers, the collaborative coordinator, and PRISM representative Emily Meyers attended the session. They reported that the session was good and that the material had been presented well. At the workshop, the three teachers from

Dobbin AV School expressed interest in trying to establish a telecommunications course at their school, but this had not been accomplished by year's end.

## Student Lunchtime Seminars

The High School of Engineering and Science and the collaborative initiated a series of student lunchtime seminars during the 1988-89 school year. Distinguished speakers from the fields of mathematics, science and computer science were invited to speak to students and teachers during their lunch periods. The lunchtime seminars were designed to involve both teachers and students, and to establish a dialogue between them. The collaborative provided funds for refreshments, and selected the speakers for the first two programs, with the science department head at Engineering and Science identifying the speakers for the other seven seminars.

Franklin Institute astronomer Derrick Pitts spoke at the first seminar, held December 8, 1988. On January 26, John Hagan of the University of Pennsylvania led a seminar on computer viruses. On February 28, George Frueh of Lincoln Technical Institute gave a 40-minute presentation on Robotics, which included the Mentor Pick and Place Robot, a SDK-86 microcomputer and the film strip "Ballet Robotique." In March, Dr. Benjamin Carson of John Hopkins University presented the seminar, "Doing the Impossible," which focused on physically separating twins and realizing your potential. The remaining five lunchtime seminars addressed the topics of Superconductivity, Being an Astronaut, Liquid Air and Lasers, Cystic Fibrosis, and Perfect Numbers.

The student seminars have been extremely successful. Approximately 40 students and 10 to 12 teachers attended each session. In a letter to the project coordinator after the December seminar, the Math/Science Department Head at the High School of Engineering and Science wrote, "The student seminar was a tremendous success! The students came away with so many good messages about science, curiosity and the excitement which can be had by being curious about science . . . ." The reactions from students and teachers have been equally favorable. Teachers' comments following John Hagan's seminar on computer viruses included, "Enchanting! I'm not computer literate yet, but I felt impressed with his knowledge"; and "He was the perfect speaker. He held my interest throughout--not too technical, but technical enough."

Students were equally enthusiastic about the presentation. One student commented, "I really enjoyed the presentation on computer viruses by John Hagan. I think the presentation is good in making students aware of how computers and systems can be sabotaged. The lecture also gave me insight on how networks work, and how viruses attack and destroy." Another student said, "The speaker was very informative. I had expected the luncheon to be boring, but to my surprise he was very interesting. He spoke very well, kept my attention, and also made me laugh. Thank him for a good speech." A third student remarked, "The presentation was interesting and informative. The information seems useful, and your presentation kept me on the edge of my seat."

The collaborative coordinator is very pleased with the success of the student seminars and encouraged the school to write a PRISM grant to continue the series for the 1989-90 school year. PRISM funded the proposal and the student lunchtime seminars will continue in 1989-90.

## Geometric Supposer Network

As a result of a collaborative workshop in April, 1987, mathematics teachers in several schools initiated a pilot test of the Geometric Supposer in their geometry classes during the 1987-88 school year. The pilot teachers joined an on-line national network of Supposer users that was established by the UMC Technical Assistance Project at the Education Development Center. In the spring of 1988, the pilot teachers met to discuss their use of the program and to share their problems and successes. The collaborative also conducted several hands-on workshops to familiarize mathematics departments with the software program.

On October 6, 1988, the collaborative hosted a meeting for teachers who were using or were interested in using the Supposer. Five teachers and four collaborative representatives attended the session, which was held at the Philadelphia College of Textiles and Science. At the meeting, the teachers agreed to participate in a network to share materials, with the collaborative serving as a conduit for information. In addition, arrangements were made for the mathematics supervisors to visit the classes of two collaborative teachers who were experienced in using the Supposer.

### Department Heads Luncheon

On December 15, 1988, the collaborative hosted a luncheon for the heads of all the mathematics departments in the Philadelphia School District. Thirty-eight department heads attended the luncheon, which was held at Roxborough High School. The department heads enjoyed the opportunity to interact. In a thank-you note to the collaborative coordinator, one department head wrote, "Every one of the department heads enjoyed the holiday gathering--it certainly gave us a chance to interact in a positive spirit."

### ACCESS

During the 1986-87 school year, the collaborative established a network for teachers of Mathematics in Applications (MIA), a new third-year nonacademic mathematics course. The collaborative also initiated the publication of ACCESS to provide sample computer activities and resources to Mathematics in Application teachers. ACCESS is a mailing of public-domain and teacher-written software, accompanied by topic-related print materials. Sue Stetzer sent the initial ACCESS mailing, which included a disk and print material, to all high school mathematics department heads and all MIA teachers. Teachers were then asked to join the network by returning either a blank disk or one containing software they had created, and/or worksheets they had developed. ACCESS materials were disseminated three times during the first year, and four times during the 1987-88 school year.

During the 1988-89 school year, three volumes of ACCESS materials were published and disseminated. The October volume focused on problem solving, calculators, and introducing statistics, to coincide with the curriculum guide; the January volume covered spreadsheets; and the May volume featured materials on probability, problem solving, spreadsheets, and templates. The ACCESS network has a core of 25 teachers who share materials and exchange disks.

### Dues to Professional Organizations

For the third consecutive year, the collaborative sponsored memberships in the local professional organizations--the Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV) and the Philadelphia Secondary Science Teachers Association (PSST)--for the mathematics and science teachers in the target schools. The collaborative paid the full price of memberships for teachers in the new target schools, and half the membership fee for second- and third-year participants who were willing to pay the remaining half. Membership benefits for both organizations include newsletters and regularly scheduled conferences. Both organizations schedule their conferences after school and on Saturdays so professional leave is not a problem; attendance at these conferences has increased significantly because of the collaborative's support.

## Grants

### Professional Enrichment Grants (PEGs)

The collaborative awards Professional Enrichment Grants (PEGs) of up to $300 each to high school mathematics and science teachers in the Philadelphia public schools to enable them to attend professional meetings, workshops, and seminars. The PEGs cover such expenses as transportation, registration, hotel, meals and conference materials. Recipients' departments are required to provide any classroom coverage that they feel is necessary. This year for the first time, only teachers in the target schools were eligible to apply for the grants.

Teachers interested in applying for a grant were required to complete a Professional Enrichment Grant application form and submit it to Sue Stetzer, the collaborative coordinator. Questions include: How does the application for financing relate to your professional development and/or will influence mathematics or science instruction?; How will you share the information gained from this experience? To avoid competition within a department, each department is asked to agree on priorities and criteria so that the selection subcommittee can evaluate each application in light of the department's defined criteria.

During the 1988-89 school year, the collaborative awarded 44 PEGs; because $9,000 was available to fund PEGs, all teachers who applied received funding. Many of this year's PEG recipients used their awards to attend NCTM in Orlando, PCTM in White Haven, or the ATMOPAV Banquet. Teachers have also used PEG funds to attend a variety of other conferences, including the National Teachers of Biology Association

(NTBA) Conference in Chicago; Science and Technology Conference in Virginia; an Apple Works Course; Junior Science Academy in western Pennsylvania; a MAC Workshop, EPECC (Eastern Pennsylvania Educator Computer Conference) held at Valley Forge; MacIntosh Conference at Valley Forge; Manhattan College Advanced Placement Course; an Advanced Placement PASCAL Course; the Exeter Mathematics and Computer Conference; and a Woodrow Wilson Institute.

PEG recipients were enthusiastic about their experiences. They shared their new insights in department meetings, at local professional conferences, and through the collaborative's monthly newsletter. There is some concern regarding the difficulties of gaining professional leave to participate in professional opportunities. While Philadelphia School District policy supports the granting of professional leave, in reality the shortage of certified science and mathematics substitute teachers severely limits professional leave opportunities for many teachers.

## PRISM Grants

The collaborative has taken an active role in encouraging teachers in the target schools to apply for PRISM Grants. Collaborative Coordinator Sue Stetzer provides individual consultation to interested teachers, and the collaborative office provides word-processing assistance. As one teacher said, "Sue's nudges push you from idea to action." This support seems to be paying off, as ten of the 49 PRISM grants awarded during 1988-89 went to collaborative teachers and 83 percent of grant applications from collaborative schools were funded.

Mini Grants. PRISM Mini Grants are available to all full-time teachers and administrators employed by the School District of Philadelphia. The Pew Charitable Trust, ARCO Chemical, and PSFS Bank donated a total of $8,000 to fund innovative classroom programs. PRISM awards individual grants of $300.

Proposals are reviewed by three representatives of the area's schools and cultural institutions. PATHS/PRISM staff make final recommendations for funding, based on readers' evaluations. Seven collaborative teachers applied for mini-grants; five were funded. Grants include: a Computer Resource Library (magazine subscriptions and software); Computer Awareness and the Job Market of the 80's (software); Math in Applications Problem-Solving Contest (book); Magnetic Manipulatives in Mathematics (magnetic white board and manipulatives); and Development and Implementation of Student Group Lab Experiments (Laboratory chemical).

Collaborative Grants. PRISM Collaborative Grants are designed to provide groups of teachers or schools with funding for innovative projects. Collaborative grant teams work together to design and implement projects that strengthen humanities, science or mathematics education. Awards up to $3,000 are available to all full-time teachers and administrators employed by the School District of Philadelphia. Proposals are reviewed by three readers who represent the area's educational and cultural organizations, with the final selection based on the recommendations of the readers and the PATHS/PRISM staff. Seven collaborative teachers applied for grants and three received funding. The successful projects were: Developing Resources for Teaching Problem Solving (books, manipulatives and software); Artificial Intelligence in the Classroom, (software and some hardware for robotics); and Software Database (software).

Workshop Grants. Professional Development Workshop Grants are available to Philadelphia teachers (K-12) who teach science, mathematics or computer science. A total of $7,500 was donated by Pew Charitable Trust and Chevron to PRISM to fund the grants. The program, which was initiated to enable teachers to share special talents and expertise with colleagues, was piloted in the spring of 1989; applications for the pilot program were due by January 28, 1989.

PRISM staff selects award recipients on the basis of: a) the value of the topic to the curriculum, b) well-defined objectives, and c) a program that clearly meets its stated objectives. Twelve collaborative teachers applied for grants of $300-$500 each; six proposals were funded, including: Activities for Math in Applications Classes; Algebra Courseware; Developing Computing Skills; Focus on Geometry; Computing Skills; and Live Animals in the Classroom. The funds were used to pay for leader stipends, refreshments, and materials for participants to implement activities in the classroom. A total of 21 workshops, which provided professional development to about 500 teachers, were funded through workshop grants.

## Regional and National Conferences

### Woodrow Wilson Institutes

PRISM and the Woodrow Wilson Foundation co-sponsored two summer institutes during the summer of 1988, one on mathematics and one on chemistry. Both institutes were held at Beaver College from 8:30 a.m. to 4:40 p.m. August 8-12, 1988. The mathematics institute focused on three themes: teaching traditional topics in innovative ways; teaching previously inaccessible topics (i.e., Markov charms, algorithms, the simplex method) using new technology; and the technology itself, including calculators, computers, and powerful software. The chemistry institute, "An Expanded Perspective on the Teaching of Introductory Chemistry," provided an intensive introduction to the operation of a high school laboratory program and featured demonstrations, hands-on experiments, model building, and computer activities. Among the topics presented were: properties of yeast, quantitative reactions, kinetics, acid based chemistry, new laboratory equipment, and computer software. The chemistry institute provided teachers with insights regarding perspectives on learning chemistry, cooperative learning and pre-lab strategies.

The registration fee for each institute was $125, which covered all curricular materials, lunch, coffee breaks and a closing reception. Teachers were also eligible to apply to Beaver College for graduate credits.

Only 14 teachers attended the mathematics institute. Of the seven participants from Philadelphia, two were collaborative teachers. Eighteen teachers participated in the chemistry institute; of the seven Philadelphia teachers, one was a collaborative teacher. The limited participation by Philadelphia teachers was attributed to the large number of teachers who were teaching summer school. PRISM provided grants of $100 to all Philadelphia public school teachers to cover most of the registration fee and one of the collaborative teachers received a PEG grant to attend the mathematics institute.

### ATMOPAV Meetings

Fall Conference. The 1988 ATMOPAV Fall Conference, co-sponsored by ATMOPAV and Beaver College, was held at Beaver College from 8 a.m. to 1:30 p.m. October 29, 1988. Approximately 375 teachers, administrators, and business and university representatives attended the conference, which focused on the theme, "Mathematics--Real Life, Not Still Life." The collaborative pays membership fees in ATMOPAV for mathematics teachers from the target schools.

The attendees seemed to enjoy the conference. One teacher commented, "As always, an important part of the conference is the exchange with fellow professionals. It was stimulating and satisfying. I think it is helpful to provide contact with publishers. The offerings of the workshops are current." Another added, "I was delighted with the sessions. The room was full and everyone enthusiastic. We discussed the NCTM Standards. Twenty-five percent of the group were either new teachers or student teachers. Half of those attending were practitioners. They were not only receptive, but reasonable in the comments." The on-site observer reported, "The ATMOPAV fall conference is usually well attended. The workshops were full and people were interested and enjoyed the sessions. This was a good conference. Dr. Marjorie Enneking was a good speaker, and the luncheon was well received."

Winter Conference. The ATMOPAV Winter Meeting was held February 11, 1989, at Abington Junior High School. The theme of the half-day conference was "Let's Communicate." Keynote speaker Dr. Jane Drucker, Associate Professor at Temple University, spoke on "Can We Blame the Messenger for Losing the War?" Approximately 200 teachers, administrators and representatives attended.

The on-site observer reported that the meeting seemed to be less varied than usual, but that there were enough different sessions that all participants were able to find something useful. One teacher commented, "One of the best parts of an ATMOPAV meeting is the networking that goes on. We get a chance to talk with each other about what is happening in each others' school. We communicate." Another added, "The workshops were good. I always come away with some new idea. I really enjoy these conferences." A third teacher said, "A good meeting. The speaker was excellent. I enjoyed attending two wonderful workshops. There were some new faces at this conference who were presenting. I found that refreshing."

Spring Banquet. The ATMOPAV Spring Banquet was held May 9, 1989, at the Williamson's Restaurant in Horsham. The evening began with a welcome and invocation, followed by dinner and an awards presentation. Among the recipients of the Distinguished Service Award were Collaborative Coordinator Sue Stetzer and On-Site Observer Joyce Neff. Dr. David Reibstein from the University of Pennsylvania, spoke on, "How Much is This Information Worth to You?" Twelve collaborative teachers were among the 100 ATMOPAV members who attended the event. The collaborative teachers received PEGs to cover the cost of the banquet.

Teachers' comments about the evening were all very positive. One teacher said, "A perfect end-of-year banquet--good food--good company and wonderful speaker." Another exclaimed, "Wow--the speaker was great--I had a wonderful time." A third teacher's response was, "It was so nice to see so many of my friends and colleagues. The speaker was terrific . . . ." A fourth commented, "This year's banquet was well attended. It was good to see so many of those I only get to see once a year. I really enjoyed the speaker--good topic." And a fifth reported, "It was my second banquet. I enjoyed attending--the speaker was great." The on-site observer reported: "A great evening. David Reibstein was a wonderful speaker--quite entertaining. Without a doubt--everyone seemed pleased to be at the banquet and enjoyed the evening."

## Annual Meeting of the Pennsylvania Council of Teachers of Mathematics

Eight collaborative teachers received PEG grants to attend the 38th Annual Meeting of the Pennsylvania Council of Teachers of Mathematics, "A Math Odyssey," held at the Mountain Laurel Resort in the Poconos, March 16-18, 1989. The 124 sections and workshops covered a variety of topics, including the new NCTM Curriculum and Evaluation Standards, Problem Solving, Calculator Activities for Learning Mathematics, Trigonometry and Technology, Robots and Mathematical Models, Calculus for a New Century, Computers and the Teaching of Mathematics, and Fractal Curves. Six Philadelphia area teachers presented at the conference.

Teachers' comments were very positive. One teacher said, "This has been a wonderful conference. I went to a few good sessions and have had a great time talking with my colleagues." Another commented, "I really appreciated getting the PEG. This way I could stay here and not try to get up at dawn to get to a workshop. It has been a great meeting." A third teacher remarked, "Good speakers, good workshops, good networking. It is really crowded but I got into everything I wanted to and feel renewed." And another, "Part of what I get out of going to these things is talking and exchanging thoughts with people. This has been most useful and I'm glad I made the effort to get here."

## Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Five Philadelphia teachers received PEG grants of $300 each to cover expenses to attend the NCTM Conference in Orlando, Florida, April 12-15, 1989.

The conference theme was "Vision for the World of School Mathematics." Throughout the day, participants attended a wide variety of sessions. In the evening, they participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Curriculum and Teaching Program. As a condition of accepting the PEG grant, teachers had to agree to attend these three evening sessions.

The five teachers who received funding to attend the conference thought that the conference was worthwhile, but expressed disappointment at the lack of events sponsored by commercial publishers. The teachers also had mixed reactions to the UMC sessions, mainly in regard to the time of day that they were scheduled. One teacher commented, "The high point of the NCTM conference was my introduction to Fractals. It has opened up a whole new world for me. I had always enjoyed how the publishers spoiled the teachers with 'giveaways' and events. This year it was not there. They did not fawn over the teachers. I felt no more respect there than in Philadelphia. The collaborative activities over-extended into my private time. We could have had a breakfast meeting but at the end of the day, you are dragging and one more meeting is too much." A second teacher said, "I found the collaborative meetings valuable. I was disappointed in not getting to talk to many new people. I could not have attended the NCTM conference without a PEG. I accomplished a great deal; I did lots of networking; made a presentation, saw about 5 presenters--I got a lot done at the NCTM Conference and am looking forward to the next conference." A third teacher remarked, "After a long, arduous day involved in attending professional improvement sessions, many of which were intense, I found that attending one more meeting during what should have been considered a release dinner-break an infringement on my private hours. The body and mind need to rest. I do appreciate having received a PEG and do not wish to seem ungrateful." A fourth teacher added, "I was disappointed that the 'perks' were not available this year. There were no large dinners, excursions, etc., provided by the publishers. The people were generally cordial. I was anxious to hear the speakers or presenters. Scheduling collaborative activities from 5 to 7 p.m. when dinner is not provided is during prime time. This year there was nothing else to do or

I would have been tied down. Also, the off-site location is not good. It would be better if the location were at the convention site." A fifth teacher commented, "The collaborative's session was wonderful. We actually talked about teaching and classroom implementation. I liked having the collaborative connection. The rest of the conference was great. I did have a bit of trouble finding the conference room; they were not well marked."

## National Educational Computing Conference (NECC)

The tenth annual National Educational Computing Conference (NECC) 1989 was held in Boston, Massachusetts, from June 20-22, 1989. The conference focused on exciting innovations in the uses of technology in education and their impact on learning in varied environments. Conference participants had the opportunity to meet informally to exchange ideas, techniques, research findings, and problems and concerns related to integrating new technologies into their educational settings. Collaborative teacher Pat Potocny of Dobbins A.V.T.H.S., who was sponsored by EDC to attend the conference, spoke on the UMC Geometric Supposer Network with representatives from other urban mathematics collaboratives.

## Collaborative Newsletter

During the 1988-89 school year, the collaborative continued its monthly publication of the Philadelphia Math Science Collaborative newsletter. The newsletter is distributed to the principals and mathematics and science department heads of all the Philadelphia high schools, as well as to all mathematics and science teachers in the 13 target schools. Edited by Collaborative Coordinator Sue Stetzer, the newsletter announces upcoming collaborative events, as well as events of interest to mathematics and science teachers sponsored by the school district and by other organizations in Philadelphia; provides updated information about the collaborative; presents topics of interest to mathematics and science teachers; and serves as a vehicle for teachers to express their views relating to mathematics and science education. One edition of the newsletter included a list of outside organizations that will provide speakers for high school mathematics and science classes. The last page of each newsletter lists a calendar of events for the month.

## E. Observations

### Project Management

Although the collaborative management experienced a period of transition during the 1988-89 school year, this shift in focus, structure, and responsibility had little effect on the day-to-day operations of the project. Sue Stetzer continued to assume the role of in-school collaborator, focusing most of her efforts on the schools new to the collaborative. The six original collaborative departments assumed more responsibility for initiating school activities and encouraging teachers to attend events. During this transitional phase, it was difficult to arrange meetings that would accommodate the schedules of representatives of both the Franklin Institute and PRISM.

The shadowing process was effective in providing Emily Meyers insights into what Sue Stetzer does as coordinator. The process, however, served to accent the differences between the current operations of the collaborative and PRISM's mode of operation, rather than helping the collaborative develop a merger strategy that would help it retain its personality as it is subsumed into PRISM. Some issues became apparent as the year proceeded. It will be difficult for PRISM to retain a collaborative coordinator who will have the same number of years of experience as Ms. Stetzer, for example, as the PRISM budget disallows and is unable to support a salary commensurate to Ms. Stetzer's. Another difference between PRISM and the collaborative is their modes of operations. At the Franklin Institute, the collaborative is clearly identified as the only teacher-directed program, while PRISM operates or coordinates several programs for teachers. In one sense, because of the other PRISM projects that work with teachers, PRISM is more suited to housing the collaborative. However, at PRISM one program monitor works with several projects and operates through teacher committees rather than through personal interactions with individual teachers, a strategy which has been effective for Ms. Stetzer. PRISM also is closely associated with PATHS and may be affected by any movement to have these two organizations develop consistency in style and approach.

Another issue of key importance is clerical support. At the Franklin Institute, the collaborative shared a full-time staff person with Wayne Ransom; 40 percent time was allotted for the collaborative and 60 percent was allocated to Dr. Ransom. This type of situation ensured that someone with working knowledge of the collaborative, who can respond to questions, and who is available to do mailings is in the office regularly. This made it easier for the coordinator to spend time in schools, making personal contacts, sharing ideas, and networking. Depending on the support services that PRISM provides, the new coordinator may be more regularly confined to the office.

The transition year has highlighted several issues that suggest that the operations of the collaborative could be significantly different under the auspices of PRISM than they have been under the Franklin Institute. Both the operating mode of PRISM and of the individual hired to fill the position of collaborative coordinator will determine to a large degree, the ultimate structuring of the collaborative's operations. Another factor to be considered will be the level of trust between the teachers and the coordinator. The teachers trusted Ms. Stetzer, in part because she came from within the system; an "outsider" may not enjoy the same ready familiarity.

The collaborative appeared to operate efficiently under a bicameral committee structure, the Steering Committee and the Program Planning Committee. These two bodies essentially operated independently of each other, but addressed many of the same issues during the year; one such issue was whether to compensate teachers for making presentations and for attending out-of-school in-services. The two committees do serve some different functions in that the Steering Committee provides an opportunity for representatives from the various sectors to communicate with one other, and the Program Planning Committee encourages teachers to interact with one another in providing input to the collaborative. It is expected that in the transition to PRISM, the dual committee structure will continue, however, because many of the members of the Steering Committee also serve on the PRISM governing board, there may be some duplication of effort.

The expansion of the collaborative to 13 schools in 1988-89 and the expectation that it will expand to 20 in 1989-90 has affected the amount of personal attention that the coordinator can pay to teachers from each of the schools. As a result, the department heads from the original six schools were required to assume some of the responsibilities previously undertaken by the coordinator. The success of this shift depended on the individual department head. In addition to the transfer to PRISM, an expansion in the number of target schools is causing some changes in the style of personal communication that has characterized the collaborative.

## Collaboration

Major forms of collaboration that have resulted from the Philadelphia Math Science Collaborative include networking among teachers and interaction between the coordinator and teachers. Through their collaborative participation, teachers have become acquainted with their colleagues, shared ideas and discussed mathematics. One teacher noted, "Within the collaborative, I have met new colleagues interested in the advancement of teaching, willing and eager to share their experiences." In some cases the networking is more formal. The Philadelphia Geometric Supposer Network, for example, brought together a group of teachers with a common interest. The handful of Philadelphia teachers who participate in this network meet occasionally, as well as interact through electronic mail with one another and with teachers from other sites. Two Philadelphia teachers have been very active on the UMC Geometric Supposer Network (Geometry Forum) operated through EDC. Forum interchanges have discussed use of textbooks, procedures for using special equipment (such as large screen monitors and pc viewers), and the operation of computer labs. The Geometry Forum has also served as a resource, to answer questions such as the difference between using the Geometric Supposer on an IBM computer as compared to an Apple computer.

The collaborative also has fostered informal networking, which generally occurs among teachers within a school. Some communication has increased between the mathematics and science teachers as well. As one teacher observed, "The collaborative has encouraged channels to open between the mathematics and science departments." Another teacher reported, "The collaborative has given math and science teachers a reason to get together." The exchange between departments has become more difficult during the school year, however, because of the restriction on time for departmental meetings stipulated by the new union/district contract. The interaction that occurs between mathematics and science teachers must be more spontaneous and less formal because of constraints imposed by the administrative structure.

Networking among department teachers also is occurring. Teachers report that talking and sharing with their colleagues fosters in them a sense of recognition of the value of working in a more cooperative environment. Asked how the collaborative has helped in forming relationships with other mathematics teachers, one teacher responded, "We talk more to each other; there is more sharing of methods; we are more helpful to each other; and we are more supportive of each other." When asked the most significant changes that can be attributed to the collaborative, one teacher noted the closer cooperation between the teachers fostered by the collaborative. There are some teachers, however, who report that the collaborative has not helped in forming any new relationships with other teachers. The overall responses of teachers indicate that the collaborative has indeed affected increased networking among teachers, but that some teachers who consider themselves frequent collaborative participants have not experienced this.

Another form of collaboration important to the Philadelphia collaborative is the relationship that has evolved between Sue Stetzer and the collaborative teachers. Ms. Stetzer's contributions to collaboration include helping teachers write Professional Development Grants, locating materials or speakers upon request, encouraging teachers with common needs to work together, and keeping teachers informed about professional opportunities. This has been a critical strategy for the development of the collaborative. With the increased number of targeted schools, Ms. Stetzer has spent more time with teachers from schools new to the collaborative.

A turning point for the collaborative was the Technology Conference in September, 1988. Through Sue Stetzer's efforts, the conference provided an opportunity for the collaborative to improve its status in the school district and with the Director of Mathematics. For a number of years, ATMOPAV had talked about hosting such a conference, but plans never materialized. Sue Stetzer and Tom Scott, a technology supervisor for the district, were given full reign and a budget of $20,000 to develop the conference for the school district. The conference was very successful and planning began immediately for a second conference to be held in November, 1989. This conference was significant for at least four reasons: First, as a joint effort between the collaborative and the school district, it furthered a positive working relationship between the two. Second, it provided a means by which the collaborative could expand its focus from attending to individual teachers to serving the needs of a large group of teachers; over 200 teachers attended the conference. Third, it was a step in the professional growth of Sue Stetzer, who had never attempted an activity of this magnitude before, and in turn increased her confidence in producing future conferences. Fourth, teachers were used as presenters, thereby allowing them to assume more responsibility in helping their colleagues.

Representatives of higher education and corporations have been involved primarily by serving on one of the two governing committees, by acting as a resource, by holding a workshop at a university, or by speaking to a group of teachers. Each of the business and higher education representatives serving on the Steering Committee attended at least one of the five meetings, and one business representative attended four meetings. Participation in the Program Planning Committee meeting was less regular. Asked about forming relationships with representatives from higher education and business through the collaborative, teachers generally indicated they have not had an opportunity to do so. As noted, teachers in Philadelphia do have other opportunities through PRISM to interact and work with members of area universities, colleges, and corporations. Therefore, this does not seem to be a need that the collaborative has to fill and, as such, the majority of its efforts can be devoted towards collaboration among targeted teachers.

It is clear that Sue Stetzer has been the catalyst to collaboration in Philadelphia; she defines her role as working with teachers and getting them involved. How this approach will be continued once the collaborative is administered by PRISM, remains unclear. In one sense, the Philadelphia Math Science Collaborative is at a stage in its development where the strategy that has worked up to now may not be applicable to further its growth. Size is a factor. It is clear that as more schools become involved, one individual cannot provide the same level of attention to all teachers at all of the schools. Another factor is the empowerment of teachers. There are some teachers who have become very active in collaborative activities and may be ready to help assume the nurturing role to other teachers, a role previously assumed by the coordinator. In this way, rather than with a single in-school coordinator, there will be a network of teachers involved as in-school coordinators. The 1989-90 school year will reveal the structures that have been developed for collaboration, how teachers are able to assume a more critical role in continuing that which has been achieved, and what a different person will contribute to defining the coordinator's position.

## Professionalism

Prior to 1988-89, the work of the collaborative was devoted primarily to generating teacher participation and increasing teacher knowledge of technology and mathematics. In response to questions asked about what has been the impact of the collaborative, teachers have noted: joining professional organizations; attending professional conferences; increasing a feeling of support; and becoming more informed. Even teachers who are very active in the collaborative are reluctant to assume the responsibility for running the collaborative, or to take on tasks such as the leadership of the Program Planning Committee.

During the 1988-89 school year, the collaborative took direct steps to address the issue of teacher leadership. To define the action needed for strengthening teacher leadership and to assure that teachers retain a voice in future collaborative decisions, three meetings of a Teacher Leadership Planning Group were conducted. These meetings were motivated by the need for a higher level of teacher involvement and indications that some teachers appeared ready to assume more responsibility.

The three teacher leadership meetings resulted in some specific, identifiable, outcomes. First, three of the teachers were chosen to attend the UMC Teacher Leadership Conference in Newton, Massachusetts in August, 1989. Second, a proposal was submitted to EDC for funds to help facilitate teachers' sharing ideas from conferences and workshops with other teachers in their district. Third, teachers began to discuss issues related to leadership. Finally, teachers demonstrated their support of the collaborative by devoting extra time to attend the meetings and expressing their wish that the collaborative would continue.

The process was not entirely successful in developing or identifying a cadre of teachers willing to assume leadership roles. One barrier to teachers' assumption of more leadership is the apparent awkwardness of one teacher assuming a dominant role or suggesting new ideas or methods to his/her peers. Strong peer pressure urges teachers to conform to the views and activities of their colleagues. Collaborative benefits have included a new sense of innovation and a new avenue by which to achieve greater credibility.

Some teachers have assumed more leadership and more professional responsibility than others, such as the three teachers selected to attend the UMC Leadership Conference. One teacher, after attending a national NCTM conference for the first time, spoke at the conference the following year. A second teacher, an expert in using Geometric Supposer, traveled to Dayton to present a software workshop to teachers. The third teacher has also become an expert in using the Geometric Supposer and has developed a sense of mission in training other teachers to use it. This teacher initiated efforts to invite a recognized expert to talk with department heads about an algebra program. What is evident is that these three teachers are accepting leadership in different ways. What they share in common, however, as was apparent in the meeting they held to prepare for the leadership conference, is that they all have some vision of how things could be better and are particularly interested in staff development for all mathematics teachers in the district.

**Mathematics Focus**

The mathematics focus of the Philadelphia Math Science Collaborative continues to encompass a variety of areas, but emphasizes the use of technology and computers. Technology in the teaching of mathematics has been a constant theme across a number of collaborative activities during the year, including: the Technology Conference; the Geometric Supposer Network; the monthly seminars at the College of Textile and Science; the publication of ACCESS; and the network for the Mathematics In Applications teachers. This emphasis on technology has had an impact on teachers. Asked about significant changes that can be attributed to the collaborative, one department head reported that the Technology Conference had touched a lot of people and that a 20-member technology advisory team had been established at her school to develop a staff development program. Another teacher reported expanded computer involvement. Other teachers report the use of software distributed through ACCESS. Other teachers credit the collaborative with their active use of the Geometric Supposer and their new status as experts to the extent that they are being asked to give workshops in other states.

In addition to the increased use of technology, the collaborative has expanded some teachers' notions of what mathematics is or how it should be taught. Some department heads have indicated that the collaborative has generated a new commitment to integrating mathematics and science instruction with real-world applications. One teacher reported, "The collaborative encourages me to try different approaches to teaching mathematics." For other teachers, the collaborative has provided examples of what can be done to increase departments' expectations for in-service programming. When one teacher was asked if awareness of current trends in mathematics education has increased because of the collaborative, he/she reported, "Absolutely. It has stimulated my interest. We as a department have been looking for speakers at a higher level more often than ever before." Another teacher responded that the collaborative has made it more convenient to know what is happening in mathematics education.

The Philadelphia area is rich in resources and programs related to the teaching of mathematics. The collaborative has served an important function of keeping teachers informed of professional opportunities and making grants available so that teachers can participate in them. The collaborative has worked with existing structures to provide programs of interest. For example, Professor Charles Pine, Director of the New Jersey Algebra Project, talked with the department heads group about an approach to teaching algebra. The collaborative's monthly newsletter also plays an important role in keeping teachers informed.

It is clear that there are teachers who have grown in their approach to mathematics education because of the collaborative. The collaborative has had a district-wide influence on the Mathematics In Applications course. Other changes during the year also affected mathematics education in the district; as a result of the new contract agreement, for example, the district curriculum committees disbanded because there is no time to meet. In addition, the ninth grade curriculum in comprehensive high schools was restructured, through the Pew Foundation grant funds. Some of the collaborative teachers are team leaders and, as such, have input into this process.

Important changes are taking place within the district. How the collaborative interacts, influences and adapts because of these changes remains an open question. What is evident now is that the collaborative has greatly affected some teachers in how they are approaching the teaching of mathematics and has kept a number of teachers informed of current trends in mathematics education. What is less clear is the actual influence of the collaborative on the teaching of mathematics by the range of teachers from the targeted schools. There is no question, however, that all mathematics teachers have had the opportunity to expand their experiences.

## F. Next Steps

The 1989-90 school year will be a challenging one for the Philadelphia Math Science Collaborative. The collaborative will operate under the guidance of co-directors Wayne Ransom of the Franklin Institute, and Dr. Fred Stein of PRISM. Ms. Sue Stetzer will serve as a consultant to the Philadelphia Math Science Collaborative in her new position with the Philadelphia Schools Collaborative, a non-profit corporation established by the Pew Memorial Trusts. PRISM will hire a project monitor who, as the new collaborative coordinator, will oversee the project's 20 target schools.

Most of the collaborative's programs will continue under PRISM. During summer, 1989, PRISM will sponsor two summer institutes in conjunction with the Woodrow Wilson Foundation; an Institute for Teachers of High School Chemistry from August 7-11, and an Institute for Teachers of High School Mathematics from August 14-18. As in the 1988-89 school year, professional Enrichment Grants (PEGs) will be available for mathematics and science teachers from target schools. Teachers will be encouraged to apply for PEGs to attend the upcoming NCTM regional meeting in Philadelphia, November 30-December 2, 1989 and the NSTA regional meeting in Atlantic City, December 14-16, 1989. PEGs also will be available to support attendance at other conferences.

The Second Annual Mathematics, Science, and Technology Conference will be held November 4, 1989. This conference is being jointly sponsored by the collaborative, PRISM, and the School District of Philadelphia. Dr. Judah Schwartz, creator of the Geometric Supposer software and professor at both MIT and Harvard, will be keynote speaker.

The in-school component of the collaborative will remain constant during the transition. The collaborative will continue to secure outside speakers, to facilitate the integration of science and mathematics, to promote the use of technology, and to encourage teacher professionalism. During the 1989-90 school year, the teachers will implement a staff development program, with funding from EDC.

# SUMMARY REPORT:
# PITTSBURGH MATHEMATICS COLLABORATIVE

by the
Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Pittsburgh Mathematics Collaborative for the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Pittsburgh Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

## PITTSBURGH MATHEMATICS COLLABORATIVE

### A. Purpose

Six goals articulated in the Pittsburgh Mathematics Collaborative's initial proposal continue to provide its focus. The project's goals are:

1. to overcome teachers' isolation and to increase opportunities for interaction;

2. to educate the community about the professional nature of high school mathematics teachers;

3. to enhance teachers' knowledge base of mathematics and its applications;

4. to provide opportunities for professional self-enhancement;

5. to provide opportunities for teacher recognition; and

6. to provide time for teacher interaction, work, and professional development.

The long-range goal of the collaborative, as stated in the 1986 proposal for continued funding, is the institutionalization of a set of structures and processes that will continuously foster teacher professionalism and will be decreasingly reliant on external administration and facilitation. In light of this goal, collaborative activities are guided by a vision that by the close of the 1989-90 school year, Pittsburgh will have:

1. an energized secondary mathematics faculty, deeply involved in mathematics curricular and policy issues, and continuously interacting with the broader mathematics community;

2. a community that is knowledgeable about secondary mathematics issues and appreciative of secondary teachers;

3. a series of mechanisms in place to promote exchange and interaction among teachers and community leaders in business, industry, and higher education; and

4. a public more aware of the importance of mathematics in students' educational development and in adults' professional lives.

## B. Context

The city limits of Pittsburgh encompass 55.5 square miles and nearly 425,000 residents. The population of the metropolitan area is 2.5 million. In the city of Pittsburgh, 74 percent of the population is white, 24 percent is black, and the remaining 2 percent is comprised of other ethnic groups, including Asians and Hispanics.

Dr. Richard C. Wallace, Jr., is completing his ninth year as the superintendent of the Pittsburgh Public School District. During the 1987-88 school year, Dr. Wallace signed a contract that extended his tenure to 1990 with an enhanced retirement package and an increased salary. These contractual concessions were granted by the Pittsburgh Board of Education when it became known that Dr. Wallace was one of eight candidates being considered for the position of chancellor of the New York City school system. Subsequent to signing his new contract, Dr. Wallace withdrew his name from consideration for that post.

Dr. Wallace is assisted by one deputy superintendent and three associate superintendents. The Division of Mathematics, directed by Dr. Diane Briars, is one of 13 divisions in the Department of Curriculum and Program Management. Within the Division of Mathematics, five supervisors monitor the K-12 curriculum, although one of the positions was vacant during the 1987-88 school year. This position was filled in July, 1988, by a secondary mathematics teacher from the district. The Pittsburgh Board of Education is composed of nine members. The new President of the Pittsburgh School Board, Barbara Burns, does not intend to alter existing Board policy.

### Demographics

The Pittsburgh Public School District is comprised of 83 schools, including 12 high schools (grades 9-12), and 16 middle schools (grades 6-8); 14 of these are regular middle schools, one is for gifted students, and one is for special education students. The district's K-12 student population has approached 40,000 for the past three years. Student enrollment has declined slightly during each of the last six years, with decreases ranging from 2.4 percent to .34 percent. In the 1988-89 school year, enrollment decreased 0.3 percent. Of the total student population, 52 percent is black, 46 percent is white, and 2 percent is Asian, Hispanic or American Indian. The percent of black high school students ranges from 99 percent in one school to 30 percent in another. Of the 12,246 high school students, 10,550 (86 percent) were enrolled in mathematics during the 1988-89 school year, with black students comprising nearly 50 percent of that population.

Of the 2,835 teachers in the Pittsburgh schools, 19.5 percent are black; given that more than half of all students are black, the School Board is attempting to provide more equitable representation by increasing the number of black teachers to total at least 35 percent of the teaching force. Of the 115 high school mathematics teachers in 1988-89, 37 percent are female and 63 percent are male. Ten percent of the high school mathematics teachers are black and 90 percent are white. All of the teachers are certified to teach mathematics and 98 percent are tenured. Only three new teachers were hired to teach mathematics for the 1988-89 school year.

The Pittsburgh Public School District operates on an annual budget; the proposed budget for 1988 was $275.685 million, a 2.5 percent increase over 1987. The 1988 budget did not require a tax increase, however, as it was accompanied by such cost-saving measures as a 10 percent reduction in central office personnel during 1988. The budget is financed by approximately 58 percent local funds, 33 percent state funds, and 9 percent funds from other sources.

During the 1987-88 school year, the American Federation of Teachers negotiated a new four-year contract beginning September 1, 1988. Under the terms of the new contract, Pittsburgh teachers became some of the best paid urban school district teachers in the nation. As outlined in the new contract, the teachers will work 183 teaching days and six record-keeping days. For the 1987-88 school year, the union and district agreed to decrease each period by one minute, for a total of 45 minutes saved from scheduled class time each week; this time, as well as 45 minutes of teachers' own time, is spent in departmental meetings on Wednesday afternoons. These changes came about through the cooperative efforts of Dr. Wallace and Union President Al Fondy, and by a vote of the teachers. This staff time was labelled TIP, Teacher Interaction Period, and is used by teachers to discuss curriculum, use of computers in teaching, and other such topics. No administrator has the right to say what will take place during the TIP. This time falls entirely within the jurisdiction of the department chair, who organizes, plans, and uses it as professional development time.

There is discussion at both the state and local levels as to whether the length of the school year should be increased from the currently mandated 180 days. Educators and administrators are divided on the issues of cost and the expanded information base that needs to be articulated to students. The Pittsburgh and Pennsylvania Federations of Teachers oppose the idea without substantial increase in teacher pay.

Norm-referenced standardized tests are not administered to Pittsburgh high school students, because the district has not been able to identify an instrument that is appropriate for the Algebra I, Algebra II, Geometry, Trigonometry and Pre-Calculus classes. What is clear, however, is the need to increase enrollment in secondary mathematics and science courses. As a result, the district has made efforts to improve the quality and pacing of these courses at all levels. Other district priorities included continued efforts to more effectively evaluate district personnel and to reduce the dropout rate. Toward these ends, the district asked each high school to develop a Center for Excellence to articulate the school's particular focus for the 1988-89 school year. In each high school, a committee of teachers and administrators established goals; one high school, for example, established a mentor program while another focused on facilitating the transition from middle school to high school. This program will continue into the 1989-90 school year.

The state has distributed about $5 million in grants to encourage teacher development of continuing education in relation to changing technology and world political and economic systems. At the same time, the school district has restructured its computer science program so that only basic programming courses are taught in all high schools. Students interested in learning more about computer science must transfer to Brashear High School, where a computer laboratory with 30 computers was established strictly for use by the mathematics department. In 1988-89, this was the only mathematics computer laboratory in the district. In 1989-90, a computer laboratory for mathematics will also be developed at Langley.

## Professional Development

Teachers in Pittsburgh have a variety of professional enrichment programs available to them, including loans, mini-grants, and special events. In order to increase the number of applicants for teaching positions in economically disadvantaged schools, for example, the state is granting teachers in these schools forgiveness of up to $10,000 in Guaranteed Student Loans. In addition, the state is implementing a testing program to determine the eligibility of aspiring teachers. The $2 million program will cover four areas: basic skills, general knowledge, knowledge of teaching, and knowledge of the candidates' special area of certification. The Pittsburgh Public School District also revised its own criteria for hiring teachers in 1988-89.

The Allegheny Conference Education Fund (ACEF) is sponsored by The Allegheny Conference on Community Development, a privately funded, non-profit organization whose purpose it is to improve the quality of life in Pittsburgh, targeting progress in education, economic growth, city planning and neighborhood development. The ACEF was established in 1978 as a flexible link between the Pittsburgh Public Schools and the city's business, government, civic and foundation leaders. Since its inception, the Fund has awarded more than $67,000 to 42 principals in the city to address building-wide concerns. It has provided more than $160,000 for mini-grants of up to $300 each for teachers to encourage creativity in the classroom and more effective methods of instruction. In addition, the ACEF awarded more than $14,000 last year to 28 project teams to address the need for enhanced parent participation in the schools. The ACEF is the funding agent of the Pittsburgh Mathematics Collaborative.

Mathematics teachers in Pittsburgh also are eligible to participate in events sponsored by the Mathematics Council of Western Pennsylvania (MCWP), an active professional mathematics organization. MCWP sponsored a winter dinner meeting January 26, 1989. Following dinner, three area mathematics teachers presented a talk "Geometry Activities for All Ages." The cost of attending the meeting was $17 for MCWP members and $20 for non-members.

Chatham College sponsored a day-long conference, "Expanding Your Horizons in Mathematics and Science," designed to educate young women about the career opportunities open to women with science or mathematics backgrounds. The career panels that made presentations at the event included an air traffic controller, a chemical engineer, a computer scientist, a financial adviser, a graphic artist, a physician, and a robotics scientist. The existence of educational institutions that share the collaborative's concerns and goals provides a community network of support as well as expanded enrichment opportunities for Pittsburgh teachers. Diane Briars participated on one of the career panels and Joanne Meldon, a collaborative teacher, led one of the workshops.

## Student Enrichment Programs

In addition to teacher development, several programs in the Pittsburgh area address the needs and concerns of students; issues include equity, the suspension/dropout rate, attendance, and achievement.

Pittsburgh ranks fourth in the nation in terms of the disparity in suspensions between black and white students. In addition, black students comprised 70 percent of the enrollment in special education classes in Pittsburgh. In response to these and other disparities for minorities, programs such as Project Esteem have been implemented. Project Esteem coordinates a dozen volunteers from the Community College of Allegheny County to tutor students from Rogers School for the Creative and Performing Arts. Several of the volunteers spend considerably more than the required four hours per month with the 20 targeted students.

The Westinghouse High School in Pittsburgh houses the district's Science and Mathematics (SAM) Program, which provides students with an enriched mathematics and science curriculum. The relationship between the two subjects is emphasized and, in addition to their regular courses, students have the opportunity to work on research projects in conjunction with professional scientists. The University of Pittsburgh conducts a tutoring program for students at the Westinghouse School of Science and Mathematics. This program is supported by funds from the Westinghouse Corporation, which also arranges for its retirees to tutor students.

The Business and Finance Academy is also housed at Westinghouse High School. The four-year academy, which serves about 120 senior high students, aims to reduce dropout rates and unemployment among black teenagers by focusing on business, finance and computer literacy. Students earn as much as $100 per year for making the honor roll and achieving perfect attendance. School officials met representatives from 18 companies to encourage them to guarantee jobs to students in this program.

During the 1988-89 school year, several partnership projects were initiated between schools and local businesses. They included a partnership project between Duquesne Light and Schenley High Tech Management Program, which included a class tour to Beaver Valley Nuclear Power Station; a joint effort between United Way and the Jr. League and Sterrett Middle School that resulted in a day-long leadership training program for eighth grade students; a partnership between Mellon Bank and Perry High School that included a program with seven tutors to help students in geometry, algebra, trigonometry, applied math and SAT preparation; and a partnership between Columbia Gas and Carrick High School that included interested Columbia Gas employees attending a dinner at Carrick, touring the school and meeting students, parents and teachers.

The Pittsburgh Promise, a program aimed at improving the educational and employment possibilities of at-risk youth, is addressing several key issues: achievement test scores, attendance, in-class graduation, the suspension/expulsion rate, dropout rates, unemployment, and teenage pregnancies. The project involves business and higher education in providing educational and job preparation, access to employment and higher education, and support in post-secondary endeavors, both through financial means and with human services, such as mentorships.

Another local incentive program, initiated in 1987 by Burger King and the Pittsburgh Press, continued in 1988-89. Under the program, all students in the Pittsburgh Public Schools who maintain a grade point average of 3.5 or better will receive two free tickets to a Pittsburgh Pirates baseball game.

In April, the City of Pittsburgh received a $12.5 million grant from the Annie E. Casey Foundation for the Pittsburgh New Future project, which targets at-risk students. Pittsburgh was one of five cities in the country to be awarded a major grant from the Foundation, and the only one to receive the maximum grant. The money will be granted over five years, with the city responsible for obtaining matching funds.

### C. Development of the Collaborative

Project Coordinator Dr. Leslie Salmon-Cox, assisted by Assistant Project Coordinator and Collaborative Liaison Barbara Bridge provide leadership for the Pittsburgh Mathematics Collaborative. Ms. Rosemarie Kavanagh, a retired mathematics teacher, continues to serve as the on-site observer. Dr. Leslie Salmon-Cox, with feedback and support from a small executive committee, is central to the collaborative's decision-making process. As the collaborative structure becomes subsumed into the district's administrative structure, many of the project coordinator's responsibilities are being assumed by the collaborative liaison and by standing committees organized under the leadership of teachers and district staff. By 1990, the immersion should be complete, with Dr. Salmon-Cox divorced from the operations of the collaborative, but available as a community ally and a resource.

Project Coordinator Dr. Salmon-Cox has maintained her high level of involvement in the collaborative during the 1988-89 school year. Not only did Dr. Salmon-Cox remain central to decision making, but her community networking activities increased, as did her involvement in planning events, writing grants, and serving as a collaborative resource.

Dr. Salmon-Cox's networking activities included active participation in a variety of organizations. As part of the Education Think Tank, organized by Mr. David Berkholtz of the Allegheny Conference, she reviewed the projects of the many education groups in Allegheny County. This group of 15 members met five times during the year at approximately six-week intervals. At the February 24, 1989, meeting, Dr. Salmon-Cox made a presentation on the collaborative. In December, 1988, Dr. Salmon-Cox served as a reactor at a conference of the Teacher Network Group in Washington, D.C. Attendees at the conference included representatives from funding agencies of other UMC collaboratives. In April, Dr. Salmon-Cox presented a paper on the collaborative at the annual meeting of the American Educational Research Association in San Francisco.

Some of Dr. Salmon-Cox's time is spent visiting schools to learn more about what teachers are doing and how the collaborative can be more responsive to their needs. In November, for example, Dr. Salmon-Cox met with a teacher of the new problem-solving course to hear his views about the course and about goals for the collaborative. In March, she spent a day in a school observing cooperative learning and attending a teachers' meeting.

Dr. Salmon-Cox also is active within the national UMC project and serves on the UMC Standing Committee that met for the first time in Memphis on May 21. She is working on a new university-driven program, "Investing Now," designed to identify, nurture, and recruit talented minority youth. The University of Pittsburgh, Carnegie-Mellon University, and Duquesne University are associated with this program.

As project coordinator, Dr. Salmon-Cox continues to serve the important planning function she has served since the collaborative's inception. While monthly meetings of the First Tuesday group provide input into the planning process, much of the planning and coordination is actually done by Dr. Salmon-Cox. For example, she and Director of Mathematics Dr. Briars worked together to specify the process by which two teachers were selected to attend the UMC Teacher Leadership Conference sponsored by EDC in August, 1989. Dr. Salmon-Cox and Ms. Bridge met before each fall dinner meeting to work out the details of the meeting; Associate Coordinator Barbara Bridge and the Liaison Committee orchestrated the spring event. Dr. Salmon-Cox met with the chair of the Steering Committee prior to its meeting to review collaborative activities and to prepare for that meeting. She scheduled the agenda so that she would speak last to emphasize the point that there were a number of collaborative-related activities that were functioning well without her direct involvement. Dr. Salmon-Cox continues to meet with both the Secondary and Middle School Instructional Team Leaders Groups, and to work with them on such activities as the development of a statement on equity for the Teacher Leadership Conference. Finally, Dr. Salmon-Cox, working with Director of Mathematics Diane Briars, has been instrumental in writing grant proposals; successful proposals include the Middle School Teachers Project funded by the National Science Foundation. Dr. Briars and Dr. Salmon-Cox recently submitted a proposal for $30,000 to Duquesne Light to extend the NSF grant for the summer of 1990.

Dr. Salmon-Cox also serves as a resource and consultant. While it was initially her role to approach others for their support and assistance, today teachers and others contact her for help. When one mathematics department needed to plan an "ex-service" (an in-service outside of their building), they contacted Dr. Salmon-Cox for advice. She arranged for Professor Edward Silver to meet with them during the school day at a local restaurant, a comfortable environment outside the university, to discuss his work. At the request of the Middle School Instructional Team Leaders, Dr. Salmon-Cox prepared a letter to parents of sixth graders, stressing that all students should take algebra in high school. Toward the end of the school year, Dr. Salmon-Cox met with the director of mathematics and a mathematics supervisor to investigate the possibility of acquiring modems to allow computer committee members to communicate electronically after their Benjamin Franklin grant comes to an end.

While the immersion of the collaborative into the district has affected the project coordinator's function, it has not diminished her level of activity. In addition to her duties at the LRDC, Dr. Salmon-Cox was absorbed with collaborative-related activities and the teaching of mathematics in the Pittsburgh school district. In 1988-89 she began serving as the Site Development Coordinator for the QUASAR (Qualitative Understanding: Amplifying Student Achievement and Reasoning), a multi-million dollar middle school mathematics project funded by the Ford Foundation and housed at the Learning Research and Development Center, University of Pittsburgh. Forty percent of Dr. Salmon-Cox's time is allocated to QUASAR.

Ms. Barbara Bridge, the collaborative liaison and assistant project coordinator, acts as the formal link between the collaborative and the Allegheny Conference. In addition to her work with the collaborative, she is involved in the Partnership in Education program and the marketing program for Pittsburgh Promise, both projects of the Allegheny Conference. Approximately one third of her time is allocated to the collaborative. In her role as assistant coordinator and collaborative liaison, she facilitates the work of the Liaison Committee, edits the newsletter, coordinates the project's interaction with business and industry, and assists the project coordinator in planning activities. One of her major efforts during the 1988-89 school year focused on the development of the Liaison Committee into a functioning group that could chart its own direction and set its own priorities. Under her guidance, the Liaison Committee evolved to the point that the May wine-and-cheese reception was planned and carried out solely by the committee. As part of her duties of linking the collaborative to other initiatives, Ms. Bridge attended the conference, "Expanding Your Horizons in Mathematics and Science" in March, a conference designed to interest young women in the fields of mathematics and science. In the future, Ms. Bridge will assume more of the responsibilities for the collaborative's operations.

In addition to the project coordinator and collaborative liaison, District Director of Mathematics Diane Briars is crucial to the operation of the Pittsburgh collaborative. Clearly Dr. Briars is instrumental in the process by which the collaborative is being subsumed by the district. As a result, she and the district's mathematics supervisors often are involved in the planning process for collaborative activities, making it difficult at times to discern between district and collaborative events. Dr. Briars formally serves on the collaborative Executive Committee, but also spends a great deal of time outside of this committee meeting with Dr. Salmon-Cox. Principle committees that contribute to the operations of the collaborative are the Executive Committee, the Secondary Instructional Team Leaders Group, the Middle School Instructional Team Leaders Group, the Liaison Committee, and the Steering Committee.

## Executive Committee

The Executive Committee, more commonly referred to as the "First Tuesday" group, meets the first Tuesday of every month. In addition to Dr. Leslie Salmon-Cox, Ms. Barbara Bridge, and Dr. Diane Briars, committee members include Ms. Nancy Bunt of the Allegheny Conference on Community Development, and Ms. Jeanne Berdik of the Partnerships in Education. The group serves as an advisory committee to the project coordinator, and oversees the collaborative's program and its links to the school district. It also serves as a sounding board for planning collaborative events. At the September meeting of the Executive Committee, for example, members discussed the plans for the collaborative's future dinner meetings. Ms. Berdik agreed to speak at one of the dinners on the roles business and industry can play in education. At the December meeting, the group discussed ways to include representatives from industry in the curriculum planning process. In April, the group helped to plan the annual meeting of the Steering Committee scheduled in May.

## Secondary Instructional Teacher Leaders (ITLs) Group

The Secondary Instructional Teacher Leaders (ITLs) Group is comprised of the mathematics instructional team leaders from each of the 12 high schools. This committee had previously been named the Mathematics Department Chairs and then the Curriculum and Policy Advisory Committee for Secondary Mathematics. The group originated through the collaborative in 1985-1986 and since has evolved into a strong working group for implementing the district mathematics program. The afternoon meetings, which typically last two to three hours, are held almost monthly at the office of the director of mathematics. While the secondary ITLs still act on collaborative-related business and serves as a communication link between the collaborative and teachers, most of the group's time is spent planning and devising district policy regarding all aspects of secondary mathematics education. The collaborative project coordinator and collaborative liaison attend the meetings, as do the two secondary mathematics supervisors.

In planning and devising policy for mathematics education in the district, the secondary ITLs receive updates on the mathematics curriculum and testing programs. For example, at the group's recommendation, students will be allowed to use calculators while taking the district's Basic Skills Test beginning in the 1989-90 school year. All students are required to pass this test or a consumer mathematics course in order to graduate from high school. This group will also coordinate efforts to involve mathematics teachers in setting the standard for the new passing score on the Basic Skills Test.

The ITLs also provide input to the director of mathematics regarding the MAP (Monitoring Achievement in Pittsburgh) tests. Concerns they have raised include the length of the test; the high number of objectives; inadequate scores, with top students answering only 24 of 40 items correctly; that taking the test is discouraging to students, partly because the difficult problem-solving items appear first on the test; and that teachers have difficulty interpreting the results. The group also helps to plan in-service programs and other professional development experiences, as well as strategies for allocating substitutes to enable teachers to attend conferences and regional meetings.

At its January meeting, the secondary ITLs drafted a letter to the President of the Pittsburgh Federation of Teachers opposing a new district guideline that required ITLs to submit a copy of the Observation and Conference Log, which is completed after each conference and observation with a department member, to the district for review by building administrators, supervisors, and research specialists. The mathematics ITLs felt that this policy violated the principle of confidentiality between them and their department colleagues. The policy was rescinded by the end of January. Another policy, which required ITLs to focus on teacher behavior to the exclusion of content in their teacher observations, was unchanged despite ITLs' complaints.

The Secondary Instructional Teacher Leaders Group has served as the major conduit for teacher input into the collaborative. Dr. Salmon-Cox keeps the ITLs informed of collaborative issues in Pittsburgh and what is happening in the national UMC network. At the ITLs' November meeting, for example, she discussed the annual UMC conference and reported on the equity forum that was held at the conference. On June 13, 1989, the ITLs convened a special meeting to draft a statement on equity for the two Pittsburgh teachers to take to the UMC Teacher Leadership Conference. The statement addressed issues of equity in terms of who is getting "shut out" of mathematics courses and how student participation in "upper level" mathematics courses can be increased; the problem was characterized not so much as a racial issue as a social and economic one. Strategies for addressing the issues of equity included reducing the number of mathematics courses available in high school, offering proven alternative instructional approaches, providing additional instruction to increase the proficiency of elementary and middle school mathematics teachers, issuing calculators to all students, and developing the Science and Mathematics program at Westinghouse High School.

## Middle School Instructional Teacher Leaders (ITLs) Group

This group, comprised of the mathematics instructional team leader from each of the 16 middle schools, was formed during the 1988-89 school year to parallel the efforts of the Secondary ITLs Group and to facilitate the operations of the middle school NSF grant. Dr. Briars oversees the group's monthly meetings, which are also attended by the project coordinator and sometimes by the collaborative liaison. Topics addressed by this group tend to be similar to those discussed by the secondary group, including curriculum updates, recommendations for ninth-grade mathematics courses, discussion of the MAP, and pre-algebra/algebra pilot. In the fall, all ITLs were asked to do a needs assessment for their departments. It was determined that middle school mathematics teachers feel the need to meet with other mathematics teachers, and that teachers need assistance in adjusting to new curriculum changes. A topic at the April meeting was how to increase the involvement of middle school mathematics teachers in collaborative events.

## Collaborative Liaison Committee

One teacher from the mathematics department of each of the 12 high schools serves on the newly formed Collaborative Liaison Committee. These teacher volunteers advise Ms. Bridge on all collaborative operations not determined by the Secondary ITLs Group, including all activities that link teachers with resources outside the school district. Key areas of committee interest include the involvement of business and industry representatives in the collaborative, and increasing the degree of participation of both secondary and middle school teachers in collaborative activities. During the year, the committee sponsored three wine-and-cheese receptions. The first two were planned primarily by the members of the Executive Committee, while the May reception was wholly the project of the Liaison Committee. Liaison Committee members were solely responsible for the planning and implementation of the event, including an extension of invitations to middle school teachers. This initiative by the Liaison Committee signified yet another step in the project's gradual development into a teacher-driven collaborative.

The Liaison Committee planned its own agenda and met four times during the school year: October 7-8, December 8, April 10, and May 22. Committee activities during the first semester focused on enhancing collegiality among its members, and maturing into a cohesive, functional group. The Liaison Committee met for the first time October 7-8, 1988. The events included a dinner Friday evening and a Saturday morning workshop to plan the goals for the year. At the second meeting, December 8, 1988, discussion focused on the types of activities that the members of the committee and the other teachers would like the collaborative to sponsor. The group stressed the need to have more wine-and-cheese receptions to provide teachers with an opportunity to meet their colleagues from other schools and to hear speakers talk about mathematics and about education in general. At the April 10 meeting, the committee reviewed teacher responses it had received from the two wine-and-cheese receptions, discussed the May reception, and asked members to write articles for the newsletter. At its final meeting of the school year, May 22, the committee reviewed the May wine-and-cheese reception and discussed the questionnaire to be distributed to the mathematics teachers, the contacts that teachers had made with those in industry, suggestions for in-service programs for the coming year, and a September picnic to kick off the fall activities. One of the members volunteered to be a part of the "Expanding Your Horizons" group, which entailed participation in a day-long conference. Toward the end of the school year, the members of the Liaison Committee distributed the needs assessment questionnaire to the mathematics teachers at their schools. The questionnaire asked teachers about their awareness of available grant opportunities, their participation in internships, their interest in inviting someone from business or industry talk to their students, and their participation and interest in the wine-and-cheese receptions held during the year.

### Steering Committee

The Steering Committee, which meets annually to discuss the collaborative's direction and activities, is comprised of 27 members, including representatives from the business and university communities, the school district, and several local funding organizations. The Steering Committee held its annual meeting for the 1988-89 school year on May 10, 1989, from 3:00-4:30 p.m. at the Mellon Bank in the Union Trust Building. Twenty committee members and teachers attended the meeting and heard members of the Executive Council and Mr. Richard Wertheimer, a mathematics supervisor and chair of the computer group, report on the collaborative and current trends in mathematics education.

Dr. Briars described the geometry pilot, an outgrowth of collaborative-sponsored activities and of the progressive environment for mathematics education established in the Pittsburgh Public Schools. She also discussed the NCTM Curriculum and Evaluation Standards, characterizing them as an approach to mathematics that stresses its value and importance as a problem-solving tool. Mr. Wertheimer described how each member of the computer group has become a specialist in an area of computer use and serves as a resource for the others. Members of that committee have conducted in-services for their departments and have offered an increment credit course for teachers from all over the city. Many committee members have received financial support from the collaborative to attend national conferences. Ms. Nancy Bunt reported an increase in the number of mathematics teachers who are applying for professional development grants, which are specifically designated for mathematics teachers; in 1988-89, there were eight grants involving a total of approximately 11 teachers. Ms. Jeanne Berdik discussed the importance of infusing job skills into the curricula by recruiting business and industry volunteers to work along with teachers in planning, developing, and implementing curriculum. She described two messages from business that are relevant to the curriculum: first, there is a need to teach promptness and other job-related behaviors; and second, employers are looking for communicators, problem-solvers, and critical thinkers.

The meeting concluded with a presentation by Dr. Salmon-Cox in which she discussed the collaborative's development and future direction. She reported that teachers' involvement in the collaborative and to related activities is increasing. The evening's presentations, she said, were reflective of the broadening scope of topics covered by the collaborative and the diverse people and groups it serves. She also noted that over the next two years, these and other initiatives will continue, while the time she personally devotes to the collaborative will diminish. Dr. Salmon-Cox described at least two spinoffs from the collaborative: the NSF middle school grant that was funded, in part, because of the strong reputation of the district and the collaborative; and the similar proposal that she and Dr. Briars are preparing for elementary school teachers. She cautioned the committee that the major issues of equity and increasing public interest in mathematics remain important challenges for mathematics educators. Finally, Dr. Salmon-Cox observed that the Pittsburgh Mathematics Collaborative and the other collaboratives in the UMC network can contribute to these goals and can continue to enhance the professionalism of the district's mathematics educators.

### D. Project Activities

The Pittsburgh Mathematics Collaborative sponsored a variety of activities for Pittsburgh's secondary mathematics teachers during the 1988-89 school year. The collaborative also helped teachers apply for Professional Development Grants offered through the Allegheny Conference Education Fund. These grants provide funding to enable teachers to take advantage of professional opportunities offered by other organizations, including professional meetings, workshops and seminars. This year, as a result of a grant from NSF, the collaborative began to extend its resources and service to middle school teachers.

### Receptions

The Pittsburgh Mathematics Collaborative Liaison Committee sponsored wine-and-cheese receptions on February 2, March 2, and May 4, 1989. Both secondary and middle school teachers were invited to attend the after-school receptions. There was a $5.00 charge for attendance at each of the first two receptions; the funds collected were used to help defray the cost of the event.

#### February 2, 1989

The first wine-and-cheese reception was held February 2, at the Grand Concourse Station Square restaurant. At the gathering, Ms. Cheryl Rambler of Gateway-Penn Financial Services presented a seminar on Pre-Retirement and Financial Planning. She stressed the need to "build a nest egg" for retirement.

Although 31 collaborative teachers and Steering Committee members attended the event, very few middle school teachers participated. The lack of attendance by middle school teachers was attributed, at least in part, to their feeling uncomfortable at a gathering with secondary mathematics teachers. Nearly three-quarters of the middle school teachers have elementary certifications, and some of these teachers feel that secondary mathematics teachers feel superior to them.

The on-site observer reported that the meeting was excellent. She said that the teachers with whom she spoke felt that the program was very good. In her concluding remarks, Ms. Barbara Bridge encouraged everyone to attend future get-togethers.

March 2, 1989

The collaborative sponsored a second wine-and-cheese reception March 2, 1989, at the Grand Concourse-Station Square restaurant. At the reception, Terry Balko, a national consultant for mathematics and science for the Houghton Mifflin Company and former mathematics teacher, demonstrated activities that could be used to reinforce learning in calculus, logic, plane geometry, probability and statistics, and topology.

Thirty teachers attended the reception. The sparse attendance was attributed to other demands on teachers' time, including other scheduled meetings and huge amounts of paper work. The on-site observer reported that the speaker was creative and innovative and that the teachers greatly enjoyed his presentation.

May 4, 1989

A complimentary wine-and-cheese reception to celebrate the end of the school year was held May 4 at the Buhl Science Center. Rather than scheduling a formal presentation, the reception was designed as an opportunity for teachers to talk with one other and to explore the center's exhibits. In order to encourage participation by middle school teachers, members of the Collaborative Liaison Committee called the middle schools ITLs to personally invite them and their faculties.

Forty-five teachers, including five to ten middle school teachers, and other collaborative guests attended the reception. The on-site observer reported that teachers appreciated the opportunity to get together with the staff from other schools to discuss their common concerns. They also enjoyed exploring the Science Center.

### Curriculum Development

In addition to the Secondary Instructional Teacher Leaders Group and the Middle School Instructional Teachers Leader Group, a variety of teacher committees or groups met to discuss the mathematics curriculum. Some of these groups have been mandated by the superintendent to revise the secondary curriculum. While these committees are under the jurisdiction of the school district, the collaborative offers support as needed.

## Geometry Pilot Program

During the 1988-89 school year, five collaborative teachers conducted a pilot test of a new approach to geometry at Langley High School. The pilot program was initiated after the collaborative and the school district sent 20 teachers to a Woodrow Wilson Institute on geometry in summer 1988. At the Institute, the teachers were exposed to an approach to teaching geometry that emphasized discovery learning, hands-on experience, and student construction of knowledge. Three teachers from Langley High School convinced other mathematics teachers in their school to join them in an effort to reorganize the geometry curriculum so that the first semester focused on reinforcing Algebra I and developing students' knowledge of geometric concepts and relationships. Work on proofs was delayed until the very end of the course. The teachers used the textbook Discovering Geometry, by Michael Serra, a teacher in the San Francisco collaborative. The pilot teachers learned of the book at a regional NCTM meeting in fall 1988, and received special permission from the publisher to use photocopies of the text until the book was published in spring 1989.

According to collaborative coordinator Dr. Leslie Salmon-Cox, "The results of the pilot have been exciting. Compared to a normal dropout rate of one-third to one-half, this year there have been few dropouts." The participating teachers reported that the number of students showing deep understanding of the material was much higher than in the past, and that students come to class, eager to get to work.

During the 1989-90 school year, the course will continue to be offered at Langley High School. The pilot will be extended to other secondary schools.

## The Computer Training Group

In August, 1986, the Pittsburgh Mathematics Collaborative received a challenge grant from the Pennsylvania Ben Franklin Partnership Program to train a select group of ten secondary mathematics teachers to become computer literate. The teachers began their training during the 1986-87 school year. They continued to meet over the summer and monthly during the 1987-88 school year to share their reactions to software they had reviewed, to design instructional modules for the training of additional teachers, and to create guidelines for the use of computers in mathematics classrooms. The group also shared ideas regarding programming and other computer issues.

Efforts during the 1988-89 school year emphasized sharing materials with other teachers, and evaluating the usefulness of the materials in the classroom, as well as students' attitudes towards them. During summer 1988, the members wrote more than 80 lessons to share with other teachers. During the 1988-89 school year, the collaborative paid two of the teachers to edit the lessons and reference them to the curriculum. A major project of the Computer Group during the year involved developing and teaching an increment credit course on using the computer to teach mathematics.

At the annual meeting of the collaborative Steering Committee, Richard Wertheimer, the facilitator of the Computer Group, described how the group of teachers had developed into "a group of experts, knowledgeable critics familiar with computers and available software."

Mr. Wertheimer, a mathematics supervisor for the district, described the teachers in the Computer Group in terms of their new levels of expertise: One, who is on special assignment, planned the new computer programs at Brashear High School; another attended an NCTM conference at Ohio State, participated in two curricular pilots, spoke at conferences, and now is an expert in the use of the graphics calculator; another is a Wordperfect expert and a resource for the laboratory at Brashear; another attended an Arizona conference on the use of microcomputers in education, is a Geometric Supposer expert and a leader in the Science and Mathematics program at Westinghouse High School; another started a computer club, and is part of the Problem Solving I pilot; a department chairperson (the only chairperson in the group) is a Geometric Supposer and a Green Globs software expert who spoke at the regional NCTM meeting; another attended the North Carolina School of Science and Mathematics (NCSSM) and is now a speaker at conferences and an avid in-service leader who considers herself part of a national network; another attended NCSSM and was transformed into an active leader and educator of teachers; another is involved in three curricular pilots, is an expert on Supercalc, has been to Exeter Academy for computer instruction and has experienced a major attitudinal change over the past three years relative to teaching; and finally, another has become a computer advocate, making sure computers are used frequently in mathematics and special education classes in his vocational high school.

While funding from the Ben Franklin Foundation expires at the end of the 1988-89 school year, the Pittsburgh Public Schools will continue to fund the activities of the Computer Group. It will receive its own budget to review software, to offer increment courses and to conduct any other activities they decide are appropriate and valuable in this area of education. The collaborative hoped to purchase modems for the members of the computer committee to enable them to be linked electronically with one another as well as connected to national bulletin boards.

## Problem Solving I Committee

In response to a 1986 state law that increased high school mathematics requirements from two years to three, the Pittsburgh School District, with the support of the collaborative, established the General Mathematics Redesign Group, a committee of five teachers and a supervisor. This group met six times during the 1988-89 school year and for two weeks during the summer of 1989. The committee began to redesign the entire three years of what is now considered General Mathematics. After identifying the goals for the general mathematics curriculum in light of the NCTM Standards, the committee created a course, "Problem Solving I" that introduced techniques in problem solving. Rather than adopting a single textbook, the committee assembled curricular materials, including activities in problem solving and data analysis from more than 20 sources. The course was pilot-tested during the 1988-89 school year. The committee plans to continue to develop Problem Solving II and Problem Solving III courses.

On February 6, 1989, the teachers of the new Problem Solving I course met to evaluate the program. The on-site observer reported that the teachers felt that the course had not, as yet, accomplished what they had hoped, and that absenteeism is a serious problem that needs to be addressed. The teachers also commented that some teachers are not using a new approach to mathematics instruction, but rather are teaching the course the same way that they taught the general mathematics course. After the pilot, the committee adopted a main text for the course along with some other materials. The committee felt that using the multiple texts as was done in the pilot was too confusing logistically for both teachers and students.

## Increment Credit Course

Beginning on February 7, the Division of Mathematics offered a course for secondary mathematics teachers, Computer Applications in Mathematics. The six-week course, which was planned and taught by the Computer Group, was designed to provide teachers with an opportunity to gain experience in four areas of computer literacy: 1) how to run a computer and a printer; 2) spreadsheets and how they can be used in mathematics classes; 3) mathematics applications software for graphing, solving equations, geometric constructions and statistics; and 4) other software relevant to teaching mathematics.

The course, which was held at Brashear High School, was taught over six three-hour sessions. There was no fee and participants who completed 15 hours of instruction received one increment credit. (A total of ten increment credits are needed to receive a $200 per year increase in salary.) Approximately 30 teachers participated in the course. The teachers were very enthusiastic about the course and all of them who came to the first class completed the course. The collaborative provided refreshments at each session.

## Middle School Mathematics Project

Dr. Salmon-Cox, the coordinator of the collaborative, and Dr. Briars, the school district's Director for Mathematics, are co-principal investigators of a major grant from the National Science Foundation to establish a model program for Pittsburgh middle school mathematics teachers. The $438,000 grant was awarded to the Learning Research and Development Center for a three-year period beginning in August 1988 and is being matched by a contribution of $386,000 from the school district. The three-year program includes several components: in-service education through workshops and time spent at the recently established Middle School Teacher Center; follow-up activities in the teachers' home schools; linkages to business and industry; invited speakers; opportunities to interact with other mathematics professionals, including secondary mathematics teachers; and leadership development for teacher participants. A key aspect of the program is that some of the in-service sessions are mandatory for the 81 middle school teachers in Pittsburgh. In addition, a teacher has been put on "special assignment" to work closely with middle school teachers in their classrooms, to follow up on their experiences at the Teacher Center and to model new instructional techniques in the use of the new Middle Grades Mathematics Project materials. It is anticipated that the program will result in the formation of a cohort of teachers knowledgeable about mathematics, issues of instruction, adolescent learning and related research--in short, mathematics professionals for middle schools.

In August 1988, a week-long in-service program was held for middle school mathematics teachers. The sessions, which ran from 8 a.m. to 1 p.m., for five days, were held at Peabody High School. During the week, three strands were presented, with five and one-half hours allocated to each strand. Dr. Howard Bower, a district mathematics supervisor, taught a strand on geometry using miras. Ms. Lynn Raith, a district mathematics supervisor, presented materials on the Middle Grades Mathematics Project developed at Michigan State University. Dr. Briars taught a strand on rational number ideas. The 57 teachers who attended were compensated by the district at the regular workshop rate of $14 per hour. During the week, additional topics were addressed by three guest speakers. Professor Gene Deskins of the University of Pittsburgh spoke on extensions to the mathematics the teachers had studied in the three strands; Professor Edward Silver of the University of Pittsburgh gave a presentation on problem solving; and Dr. William Fitzgerald of Michigan State University presented a session on probability. The project coordinator reported that the teachers' attitudes toward the materials, which had originally been cynical, were now extremely positive.

Several meetings were held during the 1988-89 school year to plan in-service and summer workshops for middle school teachers. On March 3, for example, the district mathematics staff for the Middle School Project, along with Drs. Silver, Deskins, and Salmon-Cox, met with Alba Thompson of the University of Illinois. Professor Thompson directs a pre-service education program for middle school teachers. On March 9, 1989, the Middle School ITLs Group sponsored a general meeting for all ITLs to discuss the NSF program.

## Committee Dinners and Workshops

During the 1988-89 school year, the collaborative arranged for two local businesses to sponsor dinner meetings to establish collaborative committees--the Collaboration Liaison Committee and the Middle School Instructional Teacher Leaders Group. On the Saturday following each dinner, the committee held a workshop.

### Collaborative Liaison Committee Dinner and Workshop

On Friday evening, October 7, the Pittsburgh National Bank hosted a dinner for the members of the Collaborative Liaison Committee. Following the dinner, which was held in the Executive Board Room of Pittsburgh National Bank, Dr. Leslie Salmon-Cox, Dr. Diane Briars, and Ms. Barbara Bridge briefly welcomed the committee members and then introduced Ms. Jeanne Berdik, director of the Partnerships in Education Program. Ms. Berdik discussed "Partnerships and Youth Education."

On Saturday afternoon, from 12:30 to 3:00, the members of the committee met at the Boggs Avenue Curriculum and Supervision Center. After lunch, Dr. Salmon-Cox reviewed collaborative goals, Dr. Briars spoke on the school district's perspective, and Ms. Bridge discussed the mission of the Liaison Committee. Following these presentations, the group broke into small-group working sessions to discuss school and business cooperation, and to suggest topics and speakers for upcoming events and whether they should address mathematics issues in particular or educational issues in general. The afternoon concluded with a reporting session, followed by closing remarks.

During the workshop, committee members generated ideas about a wide variety of initiatives that they might undertake. These included developing test banks, creating videotapes of mathematics applications, arranging meetings of secondary and middle school mathematics teachers, and inviting business people to talk to students about the importance of regular attendance.

The coordinator of the collaborative reported that the committee members showed great enthusiasm and were excited about developing business/school partnerships.

## Middle School ITLs Group Dinner and Workshop

On November 18, 1988, Westinghouse Electric Corporation hosted a dinner meeting for Middle School Instructional Teacher Leaders at the University Club. Following dinner, brief remarks were made by Leslie Salmon-Cox, collaborative coordinator; Stanley Herman, associate superintendent for Curriculum and Program Management for the Pittsburgh Public Schools; and Diane Briars, Director of Mathematics for the Pittsburgh Public Schools. Dr. Mary Margaret Kerr, Director of the "Commonwealth Classrooms" Program for middle school students with behavior problems, presented the keynote address on a new concept for a discipline program of in-house detention.

At 9 a.m. Saturday, members of the Middle School ITLs Group reconvened at the Boggs Avenue Curriculum and Supervision Center for a half-day workshop. After a presentation on the collaborative and school district perspectives, the group discussed idea sharing, ITLs needs assessment and the importance of a building-level needs assessment.

Twenty-one people attended the dinner and workshop. The collaborative coordinator reported that the dinner provided a positive working atmosphere and a good start for the committee. The middle school ITLs were pleased with the event.

### In-service Program

In-service programs are conducted by the district's Department of Mathematics, although the collaborative plays a tangential role. The in-services, which are planned with the input of the ITLs, often feature presentations by teachers who have received collaborative support to attend conferences and meetings. The collaborative also provides refreshments.

As part of the district program, secondary mathematics teachers are granted three half-days of in-service that address special topics in mathematics. These mandatory workshops occurred in October, 1988, and January and February, 1989. Secondary mathematics teachers also had the opportunity to attend a workshop in August, 1988.

#### August In-services

On August 24, 1988, the Pittsburgh Public Schools convened a meeting of secondary mathematics teachers in the district to discuss mathematics objectives for Algebra I, Algebra II, and Geometry. Fifty-two teachers, which is approximately two-thirds of all secondary mathematics teachers, voluntarily attended the two and one-half hour session at Peabody High School. During the meeting, the teachers offered their reactions to the draft of MAP objectives for each of the three courses. One of the teachers who was present commented, "This year in the general math track, there are some general math courses and some problem solving. Next year, there will be no general mathematics, only problem solving. It is a much more enhanced course. The plan is to get the general mathematics students to take algebra in subsequent years."

#### October Cluster In-service

The Division of Mathematics of the Pittsburgh Public Schools sponsored a mandatory mathematics in-service workshop in October for all secondary mathematics teachers. In scheduling in-service programs, the teachers are divided by school into three clusters. Each cluster has the same two-hour in-service on a different day. The fall in-service began with a one-hour general meeting in which either Dr. Briars or Dr. Salmon-Cox described the future of the mathematics collaborative; this was followed by a presentation by Dr. Briars covering semester scheduling, MAP objectives, and the Syllabus Examination Project; Mr. Worthheimer then discussed the Problem Solving I course, elementary functions, and Computer Instruction for Mathematics Teachers Project.

For the last half of the in-service, the teachers had the option of attending one of three sessions presented by teachers. Three teachers who had attended the Woodrow Wilson one-week summer institute presented geometry activities; two teachers discussed probability; and two teachers demonstrated the use of computers in the teaching of mathematics.

On October 11, 1988, from 12:15 to 2:15 p.m., 39 teachers from five high schools (Brashear, Carrick, Letsche, Schenley, and South) met at Brashear High School for the cluster in-service. Nearly all participants rated the probability workshop as a 4 or 5 on a 5-point scale, with 5 indicating "strongly agreed." The few written comments indicated teachers appreciated the classroom applications and materials. The evaluations for the geometry workshop were not quite as positive; one teacher commented that more time was needed to cover the topics. No evaluations were reported for the computer workshop.

On October 18, 1988, from 12:15 to 2:15 p.m., 24 teachers from three high schools (Langley, Oliver, and Perry) attended the cluster in-service at Oliver High School. All three workshops received ratings of 5 and 4 for having clearly defined and appropriate objectives and for accomplishing the objectives. One teacher who attended the geometry workshop commented, "This was done well and this type of presentation is very beneficial due to the fact that you actually see the effects that take place." Another teacher said, "They had a lot to share and demonstrate . . . . There was not enough time to see all things available. Therefore, we should have more hands-on time with these same presenters." A teacher who had attended the computer workshop reported that the most beneficial aspect was its "application to a real situation."

On October 25, 1988, 37 teachers from four high schools (Allderdice, Peabody, Westinghouse, and Connelley) attended a cluster in-service at Allderdice High School from 12:15 to 2:15 p.m. As at the other two in-services, teachers generally rated the workshops a 5 or 4. One teacher who had attended the probability workshop said that the most beneficial aspect of the workshop was "good suggestions for classroom use for all levels." A teacher who was at the computer workshop said, "I am 'hooked' on using the computer monitor." Another commented that the most beneficial aspect of the computer workshop was "going from the real world situation to the more complex mathematical concept--seeing manipulatives and computers used in higher math level course."

## January District-Wide In-service

An in-service workshop for all secondary mathematics teachers in the Pittsburgh Public Schools was held from 12:30 to 3 p.m. on January 25, 1989, at Oliver High School. The purpose of the workshop was to provide teachers with an opportunity to interact and to hear presentations relating to mathematics.

After a welcome by Dr. Diane Briars, Director of Mathematics for the Pittsburgh Public Schools, Mr. Paul Foerster, a high school mathematics teacher from San Antonio, Texas, spoke on the topic, "The Impact of Calculators and Computers on Algebra I and Subsequent Mathematics Courses." His presentation focused on the importance of selecting problems to which students can relate.

Following a brief break, teachers attended one of four small-group sessions: "Census Teaching Resources--Hands on and Teacher Friendly" led by Mr. David Lewis of the U.S. Census Bureau in Philadelphia, Pennsylvania; "Problem Solving for Everyone!" presented by Mr. Richard Wertheimer of the Division of Mathematics; "Recap of Woodrow Wilson Geometry Seminar" led by two teachers from Allderdice High School; and a "Question and Answer Session" conducted by Mr. Foerster. All of the presentations were well received.

The on-site observer attended Mr. Lewis' session and reported that his presentation was very worthwhile. Each participant was given the opportunity to secure a demographic print-out for a particular zip code, thereby enabling teachers to design questions that will be meaningful to students who live in those areas.

## February Cluster In-service

The school district sponsored a half-day in-service workshop held in clusters at three high schools in February. The workshops, which were planned with the input of ITLs and teachers, were consistent with goals of the collaborative. The first workshop was held February 9 at Carrick High School for all of the mathematics teachers from Carrick, South, Brashear, Letsche, and Schenley High Schools. Similar workshops were held February 16 at Langley High School for teachers from Perry, Langley, Oliver and McNaugher High Schools, and February 23 at Westinghouse high school for teachers from Westinghouse, Capa, Peabody and Allderdice High Schools. Dr. Diane Briars opened the in-service by welcoming the teachers; from 12:25 -1:15 p.m. they attended one of three presentations: "Math Features of WordPerfect" by Richard Wertheimer; "New Approaches to Geometry: The Langley Experiment" by Mr. Jerry Smith, a teacher at Langley High School; or "When Are We Gonna Have to Use This?: The Mathematics in Building a House" by Mr. William Hadley, a teacher at Brashear High School.

Following a break, teachers had the opportunity to participate in one of four round-table discussions: Algebra I, Algebra II, Geometry, or Problem-Solving I. The on-site observer reported that teachers in the Problem-Solving I session became involved in a lively discussion and raised a number of important issues, including whether to assign homework, the criterion for passing a test, absenteeism, and cooperative learning. Comments by teachers who attended the February 9 session in Algebra II indicated an interest in changes in the MAP, such as the use of open-ended questions. Teachers' ratings on questions about the appropriateness of the session were high, with averages above 4 on a 5-point scale, where 5 is the highest rating.

### Math Intensive Partnership Program

In order to enhance the rapport between representatives of business and industry and the secondary mathematics teachers in the city schools, the collaborative, at the request of teachers, has encouraged the formation of individually defined math-intensive partnerships. The first such partnership, initiated during the 1987-88 school year, was established between PPG Industries and Langley High School, which had enjoyed a working relationship resulting from the Partnerships In Education (PIE) program. The project centered on a tutoring program for mathematics students. About nine tutors from industry met with a mathematics teacher and 10 algebra or geometry students each Saturday.

## Professional Development Grants

The Allegheny Conference Fund awarded Professional Development Grants to collaborative teachers to sponsor their attendance at professional meetings, workshops, and seminars; to consult with fellow teachers and colleagues in the private sector; and to investigate areas that can enhance their professional development. Individual grants may total up to $300. The program had originally been designed for secondary mathematics teachers, but was expanded this year to include middle school mathematics teachers.

Teachers are periodically reminded of the availability of Professional Development Grants through Instructional Teacher Leaders meetings, Collaborative Liaison Committee meetings, and the collaborative newsletter. To receive a grant, interested teachers apply to the collaborative 60 days before the event for which funding is requested. The application asks teachers to provide an explanation of how the event is related to their professional development and/or how it will influence mathematics instruction. In addition, they must make arrangements with the Director of Mathematics to share the information they gain with their fellow teachers.

Eighteen grants have been awarded to 11 teachers since 1987. During the 1988-89 school year, grants were awarded to five teachers to attend NCTM in Orlando, and to two teachers to attend Advanced Placement Calculus workshops.

## Ohio State University Calculator and Computer Precalculus Project ($C^2PC$)

Schenley High School was one of 86 high schools in the United States to field test the $C^2PC$ textbook. The textbook is designed to incorporate graphing calculators and computers with function software into a new pre-calculus course. Computers and graphing calculators are used to produce accurate graphs of functions, conic equations, polar equations and parametric equations. Mr. Robert Dilts, the field test teacher from Schenley High School Teacher Center in Pittsburgh, attended a 1988 summer institute in Columbus, Ohio, to learn about the materials. In addition, Mr. Dilts attended a debriefing meeting in Columbus, Ohio, on December 10-11, 1988; and meetings during the NCTM Annual meeting in Orlando and the Ohio Council of Teachers of Mathematics meeting, both held in April, 1989.

## National and Regional Workshops and Conferences

### NCTM Northeastern Regional Conference

The Northeastern Regional Conference of the National Council of Teachers of Mathematics was held in Pittsburgh on October 12-14, 1988. The keynote address was presented by David R. Johnson, mathematics department chair from Nicolet High School in Glendale, Wisconsin, and author of the books, Every Minute Counts and Making Minutes Count Even More. Collaborative Coordinator Dr. Leslie Salmon-Cox and Director of Mathematics for the Pittsburgh Public Schools, Dr. Diane Briars, along with several teachers and Division of Mathematics staff, presented two sessions for administrators on Effective Staff Development for Mathematics Teachers. In addition, Dr. Briars led a session on the NCTM Curriculum and Evaluation Standards, and Ms. Joanne Meldon, a collaborative teacher and the Pennsylvania Mathematics Teacher-of-the-Year, was a presenter at two sessions on "Strategies Necessary for Living in a Technical Society"; she also presided over a third session. The school district provided release time and substitutes for teachers who wanted to attend. All of the high schools were encouraged to send teachers to the meeting.

### Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The Pittsburgh collaborative provided Professional Development grants of $300 each to five secondary mathematics teachers to allow them to attend the NCTM conference in Orlándo, Florida, April 12-15, 1989. The theme of the conference was "Vision for the World of School Mathematics." During the day, teachers participated in workshops, interacted with other teachers from across the country, and visited exhibits of useful, exciting instructional materials and information. In the evening, the teachers participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Teaching and Curriculum Program.

Three of the teachers who attended the conference wrote articles about some of their conference experiences for the collaborative newsletter. The teachers seemed to feel that the conference was very worthwhile and several reported that they brought back ideas that they could implement in their classes. One teacher wrote, "Instructional ideas implemented by some Australian math teachers and the 'Examine a Can' were two of the best tools I discovered during the NCTM convention to improve my teaching....I know that it is important to develop strategies to help students discover concepts in mathematics. I hope these ideas from the NCTM convention will help me do just that."

### Newsletter

In fall, 1987, the collaborative published the first issue of Graphiti, a newsletter for secondary mathematics teachers. The newsletter was published once during the 1988-89 school year in June, 1989. Ms. Barbara Bridge, the collaborative's assistant coordinator, is the editor. The 1989 issue of Graphiti contained a review of some of the mathematics-related events during the 1988-89 school year, provided an update on ongoing projects within the district, and previewed activities planned for the summer and fall. Several mathematics teachers wrote articles about their experiences at NCTM. Topics of other articles included: Professional Development Grants; a survey conducted by the Collaborative Liaison Committee; the publication of the NCTM Standards; the geometry pilot at Langley High School; a cooperative learning model at Carrick High School; and the selection of the two teachers who will attend the UMC Leadership Workshop in Newton, Massachusetts in August, 1989.

## E. Observations

### Project Management

The organizational structure of the Pittsburgh Mathematics Collaborative has remained consistent over the years: the coordinator and collaborative liaison fulfill administrative roles; the Executive Council is responsible for strategic planning; the district committees make program and policy decisions; and the Steering Committee provides support. Nonetheless, change in the focus and approach to mathematics education in Pittsburgh, while subtle, has been as dynamic as though it had been achieved through a districtwide administrative reorganization. New relationships have been forged and teachers are learning to operate in new and innovative patterns. This past year, Dr. Salmon-Cox continued to make key decisions for the collaborative in consultation with Dr. Briars and others on the Executive Committee. But a climate has been created for shared decision-making in which teachers have been brought into the process and encouraged to voice their views and concerns.

The collaborative's new committee structure, which serves as the organizational foundation for drawing teachers into the decision-making process, is key to the new climate. The Instructional Teacher Leaders are making curriculum decisions and evaluating district policies as these relate to their supervisory responsibilities. While many of the ITLs had never seen the district's basics skills tests for eighth grade students, for example, this year the Secondary ITLs Group discussed this test and made recommendations regarding the cut-off score and the use of calculators. The Computer Training Group has reviewed options for linking software to the curriculum and has discussed ways to provide in-service to their fellow teachers in the use of computers. The Problem Solving I Committee is making curricular decisions about the content and focus of the problem-solving course and on the materials that should be used. A geometry pilot group, established on the initiative of teachers interested in changing the way geometry is taught, is testing new approaches and curriculum. The Collaborative Liaison Committee is exploring ways to foster interaction between mathematics teachers and people from business and industry.

As its committee structure establishes stronger, more intricate links between the collaborative and the district, and as Dr. Salmon-Cox reduces the time she devotes to collaborative activities, project management will become more diffused. While this is in many regards a positive development, it makes it difficult to discern the structures and relationships that can be directly attributed to the collaborative from those that are derivations of other factors. The current climate and committee structure were envisioned by Dr. Salmon-Cox in the early formative stages of the collaborative as the strategies by which teacher collegiality and empowerment could be best achieved. It was also envisioned that the collaborative's long-term survival depended in part upon its compatibility with school district operations. The gradual institutionalization of the collaborative, then, is creating new working relationships among those in mathematics education; new processes by which decisions are made; new traditions that mathematics teachers share and value; new concepts of and approaches to teaching mathematics; new instruments, such as computers, that can be used in teaching; and a new vocabulary for communicating with one's colleagues. In essence, institutionalization of the Pittsburgh Mathematics Collaborative is creating a new culture of mathematics education within the district.

Several factors have contributed to the fostering or support of this new culture. As Director of Mathematics, Dr. Briars is a strong advocate for shared decision making and the partnership that has evolved between her and Dr. Salmon-Cox has worked effectively to lead the mathematics program in that direction. Dr. Briars' support for teachers interested in initiating changes and her advocacy for the NCTM Standards have been very important in creating the climate for change. The accessibility and visibility of both Dr. Briars and Dr. Salmon-Cox have contributed to teachers' conviction that they have input into the process and that they are supported in trying new ideas. Dr. Salmon-Cox has been a mentor to Ms. Bridge and has guided her in her work with the Collaborative Liaison Committee. In her efforts to create a wide base of support for the collaborative, Dr. Salmon-Cox spends a significant amount of time networking with teachers, union representatives, members of the Allegheny conference, and community members. These and other factors have worked together to help the collaborative accomplish the cooperative relationship with the district that it now enjoys.

Collaborative Liaison Barbara Bridge provides an important link with other Pittsburgh initiatives that are also working toward increasing business involvement in education. She brings experience in public relations and marketing to the collaborative. As Dr. Salmon-Cox reduces the time she spends on the collaborative and increases her activity in other areas, Ms. Bridge will assume more responsibility for performing the administrative tasks of the collaborative. These include publishing the newsletter, coordinating gatherings for teachers and others, and keeping business and industry representatives associated with the project. The Collaborative Liaison Committee is Ms. Bridge's link to teachers and is key to the collaborative's overall strategy. During the first year of its existence, the Collaborative Liaison Committee became a close working group and began to define its own direction; in the coming year, it will continue to work to set its own goals and to provide a link with business and industry.

Some issues will need to be addressed. One is increasing teachers' participation in the opportunities that the collaborative provides. For example, only a small percentage of mathematics teachers, approximately 10 percent, have applied for Professional Development Grants. It appears that teachers become more willing to apply as they become more knowledgeable of the process. While the collaborative is expanding its audience to include middle school teachers, they have been slow to join, apparently uneasy about associating with secondary teachers who traditionally have a stronger mathematics background. It is expected that the Middle School Instructional Teacher Leaders Group should provide entry into the middle school population; at this point, however, it remains to be seen whether this strategy will work or whether there needs to be a joint committee that includes both middle school and secondary school teachers.

It has been established that the collaborative has created a new culture for mathematics education within the district. To assure the long-term stability of this culture, some mechanism for acculturation, a means for bringing in new teachers, will be important. Teachers who have been actively associated with the development of the collaborative have an investment in its status and success. But teachers who enter the district, and those who have remained on the periphery of participation, will need to learn the language, concepts, and traditions of this new teacher culture. It is not yet clear what this mechanism of acculturation is or will be.

## Collaboration

Collaboration in Pittsburgh occurs primarily among teachers, with very little interaction between teachers and those in higher education and business. The committee structure has been of particular importance in fostering collegiality; teachers recognize that the collaborative was instrumental in bringing together the department chairs (Instructional Teacher Leaders) and assigning them an important role in curriculum decisions and collaborative actions. Some teachers acknowledge that they enjoyed positive relations with other mathematics teachers from their school prior to the collaborative, but in all cases the collaborative has strengthened the interaction among teachers from different schools and between teachers and professionals from other sectors.

Asked how the collaborative has helped him/her to establish relationships with his/her colleagues in other schools, one teacher responded, "Some of the teachers have become involved in projects and this has resulted in closer relationships. It provides an opportunity to meet and discuss things and this gives us a new approach." Another teacher, asked about how the collaborative has affected his/her teaching of mathematics, observed, "The teachers I've met have given me varied ideas and points of view that I can use in my classroom . . . ." In response to questions about forming relationships with mathematicians in business or industry, teachers reported on the site visits during the 1986-87 school year, but did not note any other activity or relationships with mathematicians from that sector.

During 1988-89, teachers from one of the high schools had the opportunity to meet informally with Professor Ed Silver, a professor of mathematics education at the University of Pittsburgh. Professor Silver also made a dinner presentation for the collaborative. A few teachers have attended institutes conducted by universities, including the University of Chicago UCSMP and the Ohio State Calculator and Computer Precalculus Project. These represent the major opportunities Pittsburgh teachers have had to interact with those from higher education. As of yet, the collaborative has not chosen to develop a program specifically designed to promote interaction with people from higher education. One potential avenue for this type of interaction is the middle school NSF grant.

## Professionalism

The committee structure created by the collaborative and District Director of Mathematics Diane Briars has increased teachers' involvement in decision-making regarding the curriculum and their mathematics department, as well as their participation in in-service activities. The committees have been structured to include representation from all the schools and to address specific domains. The Instructional Teacher Leaders is a well-defined group that addresses issues regarding the administration of their departments and the curriculum. One Instructional Teacher Leader reflected that in the beginning of the collaborative, teachers were saying, "Here we go again. Another project that won't last." Now the teachers view the project more positively and are impressed by its achievements to date.

In most other districts, curriculum committees are formed to select a textbook and generally only meet two or three times at the end of the year. This is not the case in Pittsburgh, where the curriculum committees--computer, problem solving, trigonometry, analyses, and statistics--feel a responsibility for becoming experts in their particular area. This commitment to becoming more knowledgeable seems to be motivated by the charge given to the committees to make changes in the curriculum; it is fostered by the opportunities committee members have to study the issues. Teachers who applied for Professional Development Grants to attend the NCTM annual meeting in Orlando described their need to learn more about their areas so that they would be better prepared to make important decisions. One member of the Elementary Functions Committee wrote on her PDG application, ". . . I need to attend as many sessions as possible on advanced mathematics and the use of technology in teaching mathematics. This will prepare me to develop the best curriculum possible for this course."

The computer committee provides an interesting example of how a committee of teachers can evolve. In its first year, the teachers were paid for their committee work, including time spent at home, through funds provided by the Benjamin Franklin grant. Committee members submitted their hours to Dr. Salmon-Cox at their monthly committee meetings, who then paid them for their time. In the second year of the grant, teachers rejected money for working at home. In the third year of the grant, teachers were not paid for any of their committee work. This left some money that could be used to purchase modems to electronically link committee members with one another and to a common printer. In the course of three years, the committee went from a paid group of commissioned teachers to an empowered group of intrinsically motivated teachers who are committed to maintaining their connection with one another.

Another important factor that contributes to the success of the Pittsburgh Collaborative is the existence of formal mechanisms to provide teachers with opportunities to relay their professional experiences to their colleagues. These include reporting to the committees, discussing information at the weekly Teacher Interaction Period (TIP), and making presentations at the district sponsored in-services. Encouraging teachers to become experts, providing the time and opportunities to learn, and fostering a feeling of responsibility to share knowledge with other teachers, all contribute to a professional environment.

The group of teachers who cooperated to change the geometry curriculum is another example of teachers who have assumed more autonomy as a result of their association with the collaborative. Their efforts have revamped one school's approach to teaching geometry, not only by those who attended the one-week summer institute, but also by other teachers who became interested. This shift required a great deal of effort as new supplementary materials had to be developed, teaching styles had to be altered as teachers learned to refrain from providing answers in order for students to develop solutions of their own, and the curriculum had to be rearranged to shift the topic of proof to the end of the course.

Some teachers are changing their roles because of the change in the climate of mathematics education in Pittsburgh. Before the collaborative, teachers did not highly regard supervisory positions, and mathematics teachers were reluctant to apply when there was an opening. At the beginning of the 1988-89 school year, a teacher who had been active on the computer committee and the problem-solving committee applied and was hired to be a supervisor. One reason he cited for applying was that the position allowed him the opportunity to pursue some interesting and innovative ideas.

Mathematics teachers who have taken advantage of collaborative opportunities and of the other changes in mathematics education in Pittsburgh also have been motivated to take action. This, however, cannot be said of all mathematics teachers in Pittsburgh. In an attempt to derive information from all of the teachers, the Liaison Committee distributed a business/education involvement survey to secondary mathematics teachers, asking them to indicate their level of interest in a variety of collaborative-sponsored programs. The cover memo to the survey, signed by Dr. Briars and Ms. Bridge, stated that the goal of the collaborative is "to promote professional development among mathematics teachers in the Pittsburgh Public School District." Opportunities listed were: Professional Development Grants to attend conferences, Mini-grants or Principals' Grants to implement projects, business/industry internships, guest speakers, and wine-and-cheese receptions. Such teachers survey suggest that the collaborative is interested in teachers' views, interests, and perceptions about the collaborative. As the Liaison Committee develops, one of its tasks will be to engage teachers in collaborative activities and to foster a stronger link between teachers and business and industry.

## Mathematics Focus

A major thrust of the mathematics program in Pittsburgh has been the NCTM Curriculum and Evaluation Standards and the need for curriculum reform. These efforts have been guided by the director of mathematics and implemented by the curriculum committees. In the 1988-89 school year, the school district piloted a Problem Solving I course, created and implemented a geometry pilot, conducted a computer course, and established a committee to revise the current Trigonometry, Analyses, and Statistics course. A conscious effort is being made to increase the level of mathematics for all students. One strategy is to limit the courses available to ninth grade students to only Algebra I and Problem Solving I for regular students and Geometry for advanced students. Those students who perform well in Problem Solving I would then be expected to enroll in Algebra I. Under this course strategy, all students completing high school would have had at least one year of algebra.

In addition to specific information from the curriculum committees and the ITL groups, teachers in Pittsburgh have been well-trained on the scope and details of the NCTM Standards. Dr. Briars has conducted in-services on the Standards and begins other in-services by relating the topics being presented to the Standards. Consequently, Pittsburgh mathematics teachers are at least aware of the current trends in mathematics education. When five mathematics teachers were asked about this awareness in October, 1988, all five reported that their awareness of current trends had increased as a result of the collaborative. The teachers attributed this to the computer committee, the problem-solving committee, the department chair, the cluster meetings, and in-services conducted by Dr. Briars. In April, 1989, nine teachers were asked how the collaborative had affected their teaching of mathematics. All were able to identify some specifics, including feedback from colleagues and workshops sponsored by the collaborative.

Some of the reform occurring in the teaching of mathematics can be attributed to the energy that is being exerted for change. For example, a member of the computer committee noted that, for the first time, each mathematics department has developed a procedure to provide teachers with access to its large screen monitor and computer.

A teacher who was piloting the Problem Solving I materials felt that some of the materials were ineffective, so he developed some of his own. In his class, ninth grade students who traditionally would be in a general mathematics class were discovering *pi* using compasses to draw circles of different radii, rulers to measure the diameters and to help estimate the area, and calculators to compute ratios. Students worked in small groups and went through a process of generating data, looking for patterns, and drawing conclusions. These same students had just completed projects in which they were presented with a situation and asked to tabulate data and write their conclusions. One group was asked to plot points on a ferris wheel as it revolved. The result was a sine curve. Another group was given a third degree equation and told that it described the rate of salmon flow in relation to the change in temperature; the group was then asked to plot points on the graph and write a conclusion. The teacher felt that these exercises were compatible with the NCTM Standards; his classes provide a good example of what can be done to engage students in doing and exploring mathematics.

The geometry pilot is yet another example of teachers reevaluating their curriculum and rethinking what mathematics students should be learning. Traditionally, proofs are covered throughout the geometry course. In the pilot classes, proofs were moved to the end of the course when it was expected that students would be better able to handle them.

The pilot teachers also needed to change their interactions with students. For example, instead of serving as the source of information and authority, the pilot teachers had to learn to give students the time and opportunity to develop their own answers. Two or three students would be given the opportunity to respond with the teacher asking only "What do you think?" In this way, students could develop ideas on their own and understand mathematics as more than a sequence of rules.

The teachers piloting the Problem Solving I courses and the new geometry course--as well as those employing cooperative learning groups--exemplify changes that implement the recommendations in the Standards. The mathematics program in Pittsburgh Public Schools is very active in trying to turn some ideas into reality. The collaborative has had a role in this, but so has the leadership provided by the Director of Mathematics, her staff, and the teachers who are serving on the committees to make it work.

## F. Next Steps

Over the summer, a number of teachers will be engaged in a variety of activities. Three middle school teachers will attend an institute in East Lansing on the Michigan State Middle School Project. Two teachers will go to Columbus Ohio to attend an institute by the Calculator and Computer Precalculus Project. A Woodrow Wilson One-week Summer Institute on Functions will be conducted August 7-11 at Duquesne University. This institute will consider the impact of technology, computer software, visualizing functions, developing mathematical models, and solving real-world problems. A summer program for middle school mathematics teachers will be offered as a part of the NSF middle school project.

The Liaison Committee will sponsor a September picnic to kick-off the new school year. During the year, the committee will emphasize increasing the interaction between teachers and representatives from business and industry. The curriculum committees will continue to meet regularly to address changes in the curriculum. And, overall, the collaborative will continue to network with the other projects in the area to strengthen the professional development of mathematics teachers.

# SUMMARY REPORT:
# ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the St. Louis Urban Mathematics Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the St. Louis collaborative to the Ford Foundation for the continued funding of the collaborative; the 1988-89 report to the Ford Foundation submitted by the St. Louis collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

## ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

### A. Purpose

As stated in the funding proposal to the Ford Foundation, which was produced with the active involvement of a group of secondary mathematics teachers, the goal of the St. Louis Urban Mathematics Collaborative is to foster a spirit of collaboration among St. Louis Public Schools mathematics teachers, university mathematics professors, and mathematicians from local business and industry. The collaborative's primary goals, as stated in the funding proposal, are:

1. Teachers will explore potential resources among businesses, industries, and universities to discover how these resources may assist them in their own professional growth and in their classroom instruction.

2. Teachers will develop, assist in developing, and implement staff training programs for themselves and for their peers.

3. Teachers will assist in improving communication and exchanges of information among all mathematics teachers within each school and across schools.

4. Teachers will promote the recognition of accomplishments and quality performance among all mathematics teachers and students.

### B. Context

The city of St. Louis has a population of approximately 450,000; the population of the entire metropolitan area exceeds 2 million. Dr. Jerome B. Jones is the Superintendent of the St. Louis Public Schools, a position he has held for six years. Dr. Jones is assisted by Deputy Superintendent Cozy W. Marks Jr., and five associate superintendents. In addition, there are four assistant superintendents: one for the high schools, one for the middle schools, one for the elementary schools, and one who coordinates the effective and efficient schools programs. The St. Louis Board of Education is comprised of 12 members. The 1988-89 school board election was a bitter contest between two factions split over the desegregation issue. Each faction won two six-year seats, and the faction more supportive of full compliance with the court-ordered desegregation plan won an additional two-year seat.

The district's 1988-89 operating budget was approximately $229 million, with a per-student expenditure of about $5,100. This represents an increase of 7.8 percent over the 1987-88 school year. A large portion of this increase is due to court-ordered desegregation and needed capital improvements. Approximately 40 percent of the district's budget is covered by local revenues, 48 percent by state funds, 10 percent by federal sources and 2 percent by the county. In June, the voters waived a school tax rollback of 51 cents for 1989-90, the sixth consecutive year that the city has opted for the waiver. As a result, $11.5 million will be available this year for court-ordered capital improvements, increased salaries, and curricular improvements. School construction and renovation was projected to cost an additional $15.6 million for 1988-89 and $27.4 million for 1989-90. The state is required to pay 71.5 percent of the renovation cost while the remainder will be paid by the school district. As of December, 1988, renovation had been completed at over one third of the 104 schools scheduled for repairs.

Budget cuts for the 1989-90 school year will eliminate 134 positions: 64 administrative personnel, 11 teaching specialists and 59 support staff positions, such as secretaries and clerk/typists. A number of new positions that will absorb many of the functions of the eliminated positions will be created in a reorganization that is expected to save the school system $4.6 million during the next school year.

In 1988-89, student enrollment in the St. Louis schools totalled 47,000, including approximately 11,000 in the city's high schools. This represents an increase of about 2 percent over the 1987-88 school year. Seventy-seven percent of the total student population in the district is black, 21 percent is white, 1 percent is Asian and less than 1 percent is from other minority groups. Fifty-one percent of students are male and 49 percent are female. Approximately 80 percent of St. Louis Public Schools students are eligible for federally funded lunch programs.

The St. Louis Public Schools employ 101 high school mathematics teachers. Fifty-seven percent are black, 41 percent are white and 2 percent represent other minorities. Beginning with the 1985-86 freshman class, students are required to have three years of mathematics in order to graduate.

The district has eight regular high schools. Student enrollment at each of the regular high schools ranges from 536 to 1,504, with an average enrollment of 980 students. Seventy-six percent of the high school students in the district are black, 21 percent are white, 2 percent are Asian and less than one percent are of other ethnic groups.

The St. Louis School District has been operating under court-ordered desegregation since 1980. One stipulation of this order is a voluntary city-county desegregation program under which any black student from a city school may transfer to a county district school in which black enrollment is under 25 percent. County districts are paid incentive funds to accept city students. Approximately 11,500 black city students attended county schools during the 1988-89 school year.

To promote racial integration, St. Louis has implemented a district-wide magnet program. The magnet program, designed to attract students from the city and county interested in a more focused course of study, encompasses 29 schools of various grade configurations, including 9-12, 6-8, K-5, and K-8. Some of the magnet programs are schools within schools. Six of these schools are designated as comprehensive high schools and offer general college preparatory courses; four emphasize international studies, foreign language and communication; four are military and basic academies; seven are arts magnets; two are open exclusively to gifted students; and six have unique programs such as Montessori, academics and athletics, individually guided instruction and action learning and career exploration. Currently, plans are underway to establish investigative learning centers with a science and mathematics emphasis within two of the magnet schools. The Magnet Program court order specified that the community had to cooperate in planning the programs. Groups represented in the science program planning process include the Botanical Gardens, the Regional Council of Science and Technology, and the St. Louis Science Center. The collaborative director currently serves on the planning committee, a role which affords the collaborative an influential voice in recommending a mathematics curriculum that would facilitate science instruction.

The magnet schools in St. Louis have attracted more applicants than can be accommodated. Current enrollment is limited to approximately 10,000 students, although the district is planning to expand the program to include 14,000 youngsters. As a result of this demand, some parents actually camped out in front of the St. Louis Public School District's recruitment and counseling office prior to registration day to ensure that their children would be placed in a magnet school. This policy of first-come first-served was in effect for the 1988-89 school year; it will be replaced by a lottery.

A cooperative effort by schools, developers and the city has been implemented in order to attract families to newly renovated inner-city neighborhoods. Magnet schools are being established in renovated areas with a number of slots in the magnet program allocated to students from the neighborhood. Since the magnet system is so popular, it is hoped that locating magnet programs in renovated neighborhoods will draw parents and children interested in quality education into the area. The neighborhood magnet program is being designed to accommodate 10 percent of the total number of children enrolled in the magnet system.

A district judge has ordered that 16 city schools must close over the next three years because the buildings are unsuitable or have fallen too far behind in their maintenance. The students will be absorbed by other neighborhood or magnet schools. In addition, he has accused city officials of impeding desegregation attempts and has threatened to replace key school administrative personnel with persons more receptive to desegregation if they continue to hinder the process. He found the School Board in contempt of court for not complying with orders to lower the pupil-to-teacher ratio to 20:1 in the city's all-black schools. The district has until February 1, 1990, to agree on a reassignment plan in order to conform to the earlier court decision.

Many of the institutions in the St. Louis area provide opportunities for the professional development of St. Louis teachers. The Mathematics and Science Education Center, the collaborative's host agency, sponsored several seminars and symposia over the 1988-89 school year, including Computers and Mathematics, The Way to the Math Solution, Geometry and Measurement in the K-8 Curriculum, Topics in Discrete Mathematics, and Implications of the NCTM Standards. Dr. Zalman Usiskin from the University of Chicago School Math Project presented the program, "A Complete Mathematics Curriculum for Average Students."

St. Louis teachers have the opportunity to earn advanced degrees through a variety of programs, including the Parson Blewett Foundation, established in honor of a former school superintendent. Textbook publishers have helped to sponsor in-service activities for mathematics teachers, and Title II funds, which are available for mathematics and science activities, have been used to sponsor teachers' attendance at professional development seminars held after school hours.

Beginning in June, 1988, the McDonnell Douglas Corporation and the Mathematics and Science Education Center piloted a summer internship program for teachers designed to enhance teachers' understandings of the application of science, mathematics and technology in the marketplace. Three seven-week positions were available at a salary of $500 per week. Three teachers from the St. Louis Public Schools participated in the program in 1988, including one chemistry teacher and one teacher who was subsequently hired by the school district as a biology teacher. No St. Louis public school teacher was selected to participate in the program in 1989.

The Woodrow Wilson Foundation held a National Science and Mathematics Leadership Institute on Statistics at St. Louis University from July 11-15, 1988. Four collaborative teachers and a guidance counselor attended. The Institute, which was presented by four master teachers, focused on providing participants with new statistical techniques that could be used in the classroom. Presentations incorporated the use of manipulatives and graphs.

The National Science Foundation sponsored a six-week Summer Institute for senior high mathematics teachers from June 19-July 28, 1989. The program, which was held at Southern Illinois University at Edwardsville, featured the study of discrete mathematics, probability and statistics; teacher sharing of ideas and experiences; the development of resource materials; and hands-on computer experience. In addition, monthly seminars will be held during the 1989-90 school year. Five St. Louis Public Schools mathematics teachers were among the 28 participants in the tuition-free institute. Each teacher received a stipend of $1,800 and a book allowance of $80. Teachers were reimbursed for travel to the monthly seminars.

The NSF has awarded a $268,000 grant to mathematics professors at the University of Missouri to create the NSF Institute for High School Mathematics Teachers on Mathematical Applications. The institute intends to train a group of teacher leaders to introduce mathematical applications to their classrooms and schools. The NSF grant provides teachers with a tuition waiver, meal and travel expenses, a stipend and materials for their high school classrooms.

There is considerable concern that the Missouri university system does not recruit or retain enough minority students. Several programs have been established to improve the situation, many of which are aimed at recruiting minorities who express an interest in mathematics and science. The Minority Engineering Program (MEP) at the University of Missouri at Rolla, in conjunction with the ARCO Foundation, sponsored MEP week for high school mathematics and science chairs to provide them with assistance in recruiting students into engineering. In another program, at the University of Missouri at Columbia, high school juniors and seniors participated in a six-week apprenticeship during the summer. Participants receive room and board and a stipend, and a university professor is assigned to each student to assist with the academic aspect of the program. A computer lab is also available for research and recreation.

## C. Development of the Collaborative

The collaborative is funded through the Mathematics and Science Education Center, which raises funds and develops programs to support science and mathematics education in the greater St. Louis area. The center is directed by Dr. Paul Markovits. The decision-making body for the collaborative is the 21-member Collaborative Council. In general, the Council develops its own goals and programs, building on the center's program only when it serves a specific collaborative need.

In July, 1988, the St. Louis Urban Mathematics Collaborative experienced a change in leadership. Dr. Helene Sherman was appointed director and Ms. Anita Madsen, a teacher at Soldan High School, was elected by the Collaborative Council as teacher chairperson. This shift in personnel signified some structural changes in the relation of the collaborative to its host agency, the Mathematics and Science Education Center. Dr. Sherman, who completed a Ph.D. in mathematics education from the University of Missouri-St. Louis in spring, 1989, assumed the newly created full-time position of mathematics coordinator of the MSEC and, as such, became the collaborative's director. Dr. Sherman taught mathematics education courses at UMSL for four years while she was working on her doctorate degree. As MSEC mathematics coordinator, she directed the center's mathematics committee and managed and administered seminars, workshops, and other programs that serve the professional needs of mathematics teachers in the greater St. Louis area. As the collaborative's director, she planned the agenda for Collaborative Council meetings, distributed the minutes, coordinated committee meetings, met with teachers and administrators, made arrangements for programs designated by the Council, and served as the liaison between the St. Louis Urban Mathematics Collaborative and various groups within the UMC network, including the Education Development Center. Combining the positions of mathematics coordinator of the MSEC and the director of the collaborative strengthened the interchange of plans and ideas between the two organizations. Dr. Sherman accepted a full-time tenure track teaching position at UMSL in May, 1989, and resigned her position as MSEC mathematics coordinator effective August 31, 1989.

Ms. Madsen continues to teach full-time high school mathematics as she serves as Council chairperson. In her role as chair, she has assisted in fund-raising, distribution of materials to teachers and coordination with EDC. Donald Thompson, a mathematics teacher at Soldan High School, is the collaborative's on-site observer.

## Collaborative Council

In September, 1988, the 21-member Collaborative Council was comprised of two representatives from business; one from higher education; two mathematics supervisors and two division administrators from the St. Louis Public Schools; 13 teachers, including Council Chairperson Anita Madsen; and the collaborative director. The two business representatives, from CNA Insurance and McDonnell Douglas, volunteered their personnel and corporate resources.

During the year, the composition of the Council changed slightly, although the total membership remained at 21. Some teachers who failed to attend meetings were replaced by other teachers; one business representative resigned; and a school district staff member, a third mathematics supervisor, and one representative from higher education were added. At its January, 1989 meeting, the Council affirmed that all teachers should be encouraged to join the Council and that members can remain on the Council for as long as they wish.

The Collaborative Council met monthly during the school year. The meetings, which were scheduled from 3-5 p.m. Wednesdays, were held in various locations around the city. Attendance at the meetings ranged from 11 to 17, with an average attendance of 13. A copy of the minutes from each meeting is sent to every secondary school mathematics teacher in the district. Dr. Sherman and Ms. Madsen met several times in August and September to prepare for the first Council meeting and to make plans for the administration of the collaborative during the year.

The Council operates both as a committee of the whole and through targeted subcommittees that are created as needed. In the monthly meetings, committee reports and other relevant information are presented, upcoming events are announced, decisions are made, plans for activities are coordinated, and funds are allocated. At the October meeting, chairs of standing committees were appointed: Permanence Committee (Winifred Deavens), Seminars and Workshops Committee (Paula Eschman and Nellie Williams), Curriculum Committee (Jerome Burke), Social Committee (Bill Stadtlander), Symposia Committee (James Richmond and Anita Madsen), Business Committee (William Carroll), Math Fair Committee (Gloria Clark), and Math Contest Committee (Gayle Coleman). During the year, additional committees were formed to address issues of fund-raising and the budget; professional development (Helene Sherman); and the Veiled Prophet Fair (Theresa Stockman). The Fair is an annual four-day educational event; in 1989 it will be held in July. Four projects were identified for professional development: outstanding teacher award, newsletter, math clubs, and calculator/computer institute. A committee of up to five Council members was designated for each of the four professional development projects.

The MSEC, in cooperation with the Council, contracted with former Collaborative Director Judy Morton to serve as a fund-raising consultant beginning in July, 1988. With the help of the Collaborative Council, Ms. Morton generated a list of businesses that would be appropriate for fund-raising contacts. Before the Council took action, the list was submitted to Dr. Markovits for his approval. At the October Council meeting, Ms. Morton reported on the businesses that had been contacted. Despite these efforts, however, no money was raised through her efforts and fund-raising was not discussed at subsequent meetings of the Council.

During the year, the Council voted to fund teachers' expenses to attend conferences, to buy copies of Everybody Counts for each school and for each Council member, and, if needed, to provide cash awards, trophies and calculators for the Math Fair. The Council also voted to require that requests for funding for teacher projects be submitted to the Council in writing.

In January, the Council approved the formation of a policy board, specifying how the membership would be allocated among business, higher education, SLPS district staff, and teachers. The policy board was to be established during the spring of 1989, but its formation was delayed until more concrete plans could be developed toward permanence. At its April meeting, the Council approved two motions to direct EDC's intervention into the process of developing a permanence proposal. One motion required that Dr. Sherman be present at meetings between EDC representatives and the facilitator designated for the permanence process. The other motion requested clarification from EDC as to what it saw as the key goals and issues of the St. Louis collaborative. Program recommendations for 1989-90 and the evaluation of future programs were discussed at the May meeting.

**Planning for Permanence**

The St. Louis Urban Mathematics Collaborative formally began planning for permanence in June, 1988, when a permanence committee was appointed. Despite this initial effort, however, progress has been slowed by a number of factors, including the change in directors in July, 1988. The Permanence Committee prepared a draft proposal in the fall of 1988 that listed a number of questions organized under three general headings: Structure; Funding and Support Systems; and Program and Activity Emphasis. This document was submitted to EDC, as well as to other key constituencies for their reactions. EDC's response outlined five criteria that were essential for a permanence plan: a coherent vision; a set of clearly articulated activities for implementing the vision; evidence of increasing teacher involvement; evidence of collaboration and commitment of the school district; and evidence of involvement and commitment of the business and higher education communities. EDC suggested that the Council involve a broader based committee or policy board in the process, rather than the planning group composed primarily of teachers.

During the same time period that the Permanence Committee was preparing its draft for discussion, the collaborative director prepared the interim report describing the project's progress and future direction, as required by the Ford Foundation for continued funding of the collaborative. The report was written by Dr. Sherman immediately after her appointment, and submitted to EDC for review in December, 1988. In general, readers observed that the report lacked a clear vision for the collaborative; in response to this critique, the report was rewritten by Dr. Sherman with input from others, and submitted to EDC in January. The report described the formation of a policy board, called an Advisory Committee, as part of the collaborative's permanent governing structure. The concept of a policy board was approved by the Council at its January meeting. Although the report was sufficiently strong to allow the Ford Foundation funding to be released, concern about the collaborative's evolution and potential for permanence remained.

This concern was communicated in February in a letter to Dr. Markovits from the Ford Foundation. The letter questioned the likelihood of the St. Louis collaborative formulating its own identity and establishing a strong link with other mathematics initiatives in the area. The collaborative was encouraged to use the permanence process to build on current strengths while it remained responsive to new ideas. The collaborative was granted an extension for submitting its permanence proposal without additional funds to June, 1990.

Throughout the 1988-89 school year, EDC assisted the collaborative in its efforts to increase the number of participants involved in the process of developing a permanence plan. In February, Dr. Driscoll met with Dr. Markovits and Mr. Pearson, the Associate Superintendent of SLPS, to discuss the district's involvement in and commitment to the collaborative. On March 13, Dr. Driscoll and Mr. Brian Lord of the EDC Outreach Project met with three Council members, Executive Director of Curriculum Services Mr. Price and two mathematics supervisors, at Dr. Sherman's house to discuss the issues of permanence. The discussion focused on identifying the important changes brought about by the collaborative, and formulating a vision that would impact on area businesses and create closer ties with higher education. This group decided that the entire Council should constitute the Permanence Committee and that there should be three sub-committees: one each on funding, vision, and proposal. On April 25, on Mr. Pearson's recommendation, Dr. Driscoll met with Dr. George Hyram, Vice President Emeritus at Harris Stowe College, to ask his help in facilitating the process leading to permanence. Dr. Hyram agreed to be the facilitator and was engaged by EDC to accomplish three tasks: bring people together to define the collaborative's vision; develop a plan and identify the support needed to move toward the vision; and prepare a proposal to be submitted to the Ford Foundation through EDC. Dr. Driscoll met with members of the Council on May 12 to describe the role that Dr. Hyram would assume. On June 9, Dr. Hyram met with the Council to discuss permanence and the process that would foster it. At the end of June, 1989, the collaborative was still engaged in developing a proposal to be submitted to EDC and the Ford Foundation.

## D. Project Activities

During the 1988-89 school year, the St. Louis Mathematics Collaborative sponsored a wide variety of activities for high school mathematics teachers in the St. Louis Public Schools. This year, middle school teachers (grades 6-8) were invited to participate in several of the activities. The collaborative also promoted teacher participation in a variety of activities that were sponsored by other organizations, but were related to fulfilling collaborative goals.

### Collaborative-Sponsored or Supported Local Conferences, Workshops, Seminars and Symposia

Seminar Series on Mathematics Education

The St. Louis collaborative sponsored two seminars during the 1988-89 school year that focused on mathematics education in other countries. The seminar series was designed to provide teachers with an international perspective on mathematics education.

The first seminar, "The Role of Problem Solving in the Teaching and Learning of Mathematics" was held April 9, 1989, from 4-6 p.m. The guest speaker was Julia Szendri, the National Director of Math Education in Hungary. The seminar was planned to provide teachers with an opportunity to compare changes in mathematics in Hungary with those in the United States. The event was held at a local restaurant and was open to all collaborative members and administrators, as well as to a few guests from private and county schools. Eight collaborative teachers, three non-collaborative teachers, the collaborative director and coordinator and a university faculty member attended. Because the seminar was held on a Sunday afternoon, a large attendance had not been anticipated.

The teachers who heard Dr. Szendri's lecture found the session intriguing. One commented, "The session covered education in Hungary from K-12. I was surprised to know that they start teaching Algebra . . . as early as kindergarten or first grade . . . ." A second teacher said, "A good session. The fact that they seem to have a language problem with math symbols was interesting. This probably leads to some of the different ways they do problem solving . . . ." Another teacher remarked, "These types of collaborative activities are good. I like the international flavor. It is also good to know that other countries have the same problems we have. I believe they may be ahead of us in solving them." A fourth teacher commented, "I like the nice informal atmosphere of the small crowd there. She gave a wide perspective on education in Hungary. I found it very interesting. It is good to have sessions that are not so subject-oriented."

The second seminar was held on May 9, from 3:30-5:30 p.m. at Ralston Purina.

Dr. Jan de Lange, Secretary of the International Group for the Improvement of Mathematics Education, presented a lecture entitled "Is Multiple-Choice Testing a Dead Duck Issue?" Dr. de Lange highlighted mathematics education in the Netherlands. Following a question-and-answer period, collaborative director Helene Sherman presented the Gus Clark UMC Outstanding Teacher-of-the-Year Award to Sarah Martin, the department head at Sumner High School. Ms. Martin has been a classroom teacher in the St. Louis public school system for many years and has taught many of the SLPS teachers.

While only 20 participants--16 collaborative teachers, the collaborative director and coordinator, one school administrator and a representative from higher education--attended the lecture, those who did attend enjoyed the presentation. The lower-than-anticipated attendance was attributed to both a delay in distributing notices about the event and the busy time of the year.

One teacher commented, "I attended to see Mrs. Martin get the Teacher-of-the-Year Award. I wish there had been more people out. Next year maybe a dinner or something similar to that could be scheduled. I enjoyed the speaker." A second teacher said, "I was glad to see Sarah Martin get the Teacher-of-the-Year Award. I am glad to see this started. Next year it should be planned earlier. I enjoyed the speaker. They seem to have been doing for several years what we are trying to start. I got some good ideas from him." And another, "This type of seminar is good. Not so subject guided. I got an overview of the school system in the Netherlands. I don't believe we are willing to spend the money on the education they are. A free education through college--that would be beautiful. I don't know what we can do to get more people out."

## Dinner Symposium

On February 9, 1989, the St. Louis collaborative sponsored a dinner symposium, "If-ing and Becausing: The Real Basics in Children's Thinking." Dr. Thomas O'Brien of the Teachers' Center at Southern Illinois University in Edwardsville spoke on how children think, the software and methods that could be used to improve their thinking, and what is being done in England to improve mathematics. At 6 p.m., following the presentation, the collaborative hosted a buffet dinner.

Thirty-two teachers and school administrators attended the symposium, which was held at Garavellis' Restaurant. Attendance was somewhat lower than expected. Some of the teachers commented that more teachers would have come if the flyer had been more specific about the lecture topic. One teacher commented, "I thought he gave some very good suggestions to be used in problem solving. More people would have attended if they had known exactly what they were going to." Another said, "I was very interested in the ideas he shared on international studies of math. England seems to be doing many of the things we are trying to do. The rest was good, but a lot like most of the other speakers I have seen . . . ." A third teacher remarked, "It is nice to know that we have someone on the local level that is very competent in the new methods of teaching. I found the games very enjoyable. I could spend much time playing with them, myself. I know the students would learn problem solving and critical thinking from these games. We should have more of these types of activities."

## Technology Conference for Secondary Mathematics Teachers

On January 23, 1989, 90 collaborative teachers and administrators attended the Technology Conference for Secondary Math Teachers at the Chip Room, Inc., a union hall. The workshop was funded with Title II monies with financial assistance from book company DC Heath, and IBM. The in-service was planned by the district mathematics supervisors with recommendations from collaborative members. It was designed to aid teachers in implementing the new curriculum and to increase their use of videos and calculators in their classrooms. The conference featured presentations by Dr. Irwin Hoffman on the IBM Mathematics Exploration Toolkit and Dr. Franklin Demana who addressed "Concept Development With the Scientific Calculator." Dr. Hoffman had been recommended by the mathematics supervisors based on a presentation he had made at a previous collaborative function.

The teachers seemed to be impressed with the IBM Mathematics Exploration Toolkit and with the calculator, although many of the teachers commented that Dr. Hoffman's presentation was similar to the one he had given the previous year. While many of the responses to the conference were positive, the on-site observer reported that teachers who had heard Dr. Hoffman's address on pre-calculus the previous year and those who teach mathematics classes below the third-year level did not enjoy the workshop as much as the other participants. One teacher said, "The Toolkit is a wonderful machine. I would like to see one in every classroom. I believe his presentation was too advanced for most of our students. Pre-algebra and slow algebra students could never understand what he was doing. I don't think he has had much experience with the type of students we are teaching. I picked up some good ideas in using the calculator. I feel another short workshop on using the calculator would be good." Another teacher commented, "I had seen the Toolkit. It is something we need in every classroom along with a [PC viewer] projector. I would like to have some hands-on experience with the Toolkit. Just watching a second time was not near as exciting as last time. The calculator demonstration was good. I need to sit down and learn to use the many functions on it."

A few teachers also commented that they would prefer smaller workshops. One said, "Dr. Hoffman shows a lot of excitement. His presentation was good. I was glad to get out of the school. This is a good start for a technology conference. Maybe next year more exhibits and smaller workshops would be good. At least the supervisors are trying."

### Mathematics Fair

The collaborative, in cooperation with the St. Louis Public Schools, sponsored the second annual Mathematics Fair, March 6-8, 1989, at the Curriculum Division Offices of the St. Louis Public Schools. The fair was initiated in order to foster creativity, problem-solving skills and a general interest in mathematics among high school students. The nine-member teacher committee that planned the fair met five times during the summer of 1988 and regularly during the 1988-89 school year. While the collaborative had allocated up to $2,500 to cover expenses, including prizes, materials, bus transportation, and substitutes, the collaborative funds were not needed, as 11 private industries and the St. Louis Public Schools Partnership Program donated enough funds to finance the fair.

This year 148 projects were entered, as compared to the 88 projects on display at the first fair last year. Each project was entered in one of three categories: Exposition/Development, Investigation, or Computer Programming. As during last year's event, a number of elementary, middle, and high school mathematics classes visited the fair while the projects were on display. However, due to a snowstorm, schools were closed two of the three days that were to be allocated to student viewing. The exhibits were moved to the office area of Assistant Superintendent Julius Dix and special transportation was arranged to enable students to view the display.

On the evening of March 8, the last day of the fair, a ceremony was held during which awards were presented in the Senior Division, Junior Division and Sophomore and Freshman Division. The guest speaker was Mr. George Vaughn of McDonnell Douglas

Aerospace Information Services, and Dr. Dix presented the closing remarks. The winner of the 12th grade computer division also took first prize in the St. Louis Science Computer Project. This exhibit was fourth (and the highest placed American entry) in an international competition.

The on-site observer reported that the fair was extremely successful and that many teachers commented that it was one of the best ideas to come out of the collaborative. Although teachers had several suggestions for improving the fair, including giving the students' feedback about their projects, improving the judging of the computer software, and moving the Awards Ceremony from the evening to during the school day, teachers' comments were very favorable. One teacher said, "This was one of the best ideas that has come out of the collaborative. This shows what our teachers and students can really do. Most of the projects were very good. Some need a lot more work. We need more judges and better explanations of their work." Another commented, "Everything went over great. We all worked very hard and it was a success. If the same people work next year, we can clear up the few problems we had with numbering and the judging of the computer programs. We need more judges so we are going to have to start working earlier. Dr. Dix seems to be really behind us." A third teacher said, "I was worried about the financing since we got a very late start, but sponsors really came through at the last minute. We now have enough money to pay for everything and maybe some left over to start next year. I think next year we may be able to buy some supplies. We need more workers, everybody had to work so hard." The speaker from McDonnell Douglas said, "I really enjoyed coming back to the public schools to speak. I graduated from Cleveland High. I am proud of the public schools." Assistant Superintendent Dix said, "I wonder where the media went? It is too bad they will not cover such academic events as the math fair and contest. If this were the basketball championship, all of them would be here. I am moving the fair to my office building so that more students can view the projects. These are too good for just a few people to see."

## Secondary Mathematics Contest

The Second Annual St. Louis Public Schools Secondary Mathematics Contest was held April 8, 1989, at Southwest High School. The contest, which was co-sponsored by the collaborative and six area businesses, was designed to provide a vehicle for competition between the area high schools and to improve students' test-taking skills and SAT scores. A seven-member teacher committee planned the conference, meeting numerous times over the course of the school year. Each St. Louis high school was permitted to enter eight students, two per grade level, to compete for individual division and team awards. In total, 108 students representing all but one high school participated. Teachers and selected students were invited to videotape a segment that would appear on the TV program, "The Charlotte Ottley Show: Eye on St. Louis."

Although teachers had dissenting opinions and some concerns about the difficulty and selection of the test questions, most seemed to feel that the contest was a valuable activity for their students. One teacher remarked, "Very successful. The committee did a very good job again this year. The sponsors from businesses provided some very nice prizes. The speaker was very good. The contest is a very good idea. I was glad a student from a regular high school won." Another commented, "The fair and the contest are the big things that have come out of the collaborative. Both were well-organized and really help our students. I don't think we will ever agree on the test questions. It is just like us at the regular schools competing with the Parkway District. They always win. At least this way someone in the public schools will win and maybe do better at state and district contests."

Mr. William Carroll of CNA Insurance commented, "We are very glad to be a sponsor at such an important event. As important as math and science are and are going to be in the future, I am glad to see so many young men and women participating in the contest. We will sponsor again next year." In the closing comments, Dr. Julius C. Dix, Assistant Superintendent of Secondary Schools, praised the students for good work and thanked all sponsors and teachers who helped with the contest.

## Social Gatherings

During the 1988-89 school year, the collaborative sponsored two events for mathematics teachers and administrators to provide them an opportunity to meet and network outside the work setting. The socials also served to attract teachers who had not previously participated in collaborative activities.

### Holiday Social

A Holiday Social was held on December 22, 1988, at the St. Louis University Memorial Center. Approximately 30 teachers, four school administrators, and one representative from higher education attended the wine-and-cheese reception. Each guest received a coffee mug favor that had been donated by D. C. Heath and Harcourt Brace Jovanovich. The collaborative had hoped that more teachers would attend the event.

The teachers who attended reported that they had a good time and appreciated the opportunity to attend the socials. One teacher commented, "I always look forward to getting together to talk with other teachers. This is about the only time I see some teachers. We should wear name tags. I did not know all of the teachers." Another added, "The same teachers usually show up. I wish we could get some new teachers out. On the other hand, some teachers only show up at the socials. So keep up the socials."

### Spring Social

On April 21, 1989, at 3:30 p.m., the collaborative sponsored a Spring Social at Garavellis Restaurant. All collaborative teachers and guests, as well as middle school mathematics teachers, were invited. Twenty-five collaborative teachers, the collaborative director and coordinator, five non-collaborative teachers, four school administrators, two representatives from business and one from higher education attended the afternoon of complimentary refreshments and fellowship.

The on-site observer reported that all of the participants had an enjoyable time talking with their colleagues. A few of the teachers who attended had expected that the Teacher-of-the-Year Award would be presented at the social and were disappointed that the presentation had been postponed. One teacher said, ". . . . These are a big uplift . . . . I wish we could have more." Another commented, "Good turnout. Everyone enjoyed themselves. I usually don't come but I thought we were going to give the Teacher-of-the-Year Award to Mrs. Martin. I really enjoyed myself and I am glad I came." A third teacher remarked, "Real nice. I started not to come but I am glad I did. I will look forward to the next one. I am going to try and get more involved in the collaborative." Another teacher said, "We had a very good turnout . . . . There were some strangers there . . . . I guess Helene invited them or the word must have gotten out to other schools. Anyway, the attendance looked better."

### Subject-Area Study Groups

During the 1988-89 school year, the collaborative initiated the formation of subject area study groups, designed to focus pedagogy on the new curriculum. The school district had received new textbooks in the fall of 1988, and at the fall in-service meeting, the teachers identified several interesting study topics. In December, organizational meetings were held for the groups and a total of ten teachers attended: two teachers attended the General Mathematics and Applied Mathematics meeting; six teachers attended the meetings for Advanced Algebra, Elements of Mathematics, and Geometry; and two teachers attended the Trigonometry/Analytic Geometry meeting. No one attended the session for Algebra or Calculus.

The study groups scheduled their second meeting in February. While no one attended the meeting of the Geometry group on February 1, five teachers attended a meeting of the Trigonometry and Algebra groups during which teachers examined software. A meeting of the General Mathematics and Applied Mathematics group was to be held February 21 to discuss the special problems associated with remedial centers and special application activities, but the event was cancelled due to lack of interest.

The Curriculum Committee, which planned the earlier meeting of the study groups, had discussed the possibility of identifying a teacher-leader for the study groups, but the committee did not follow through. They attributed the poor response to the study groups to the teachers' need to become more familiar with the new texts, and the teachers' consequent inability to establish clear objectives for each group.

### Regional and National Conferences and Institutes

As part of its effort to promote the professional development of teachers, the collaborative helped to support collaborative teachers' attendance at a variety of local, regional, and national conferences.

#### MSEC Workshop on Using Manipulatives

On October 13, 1988, the Math Science Education Center sponsored a workshop at Parkway High School on implementing and managing small group instruction with manipulatives. The program, "Using Manipulatives for In-Depth Concept Development," was presented by Barbara Montalto of the Texas Education Agency. The workshop was open to all teachers in the St. Louis area.

The collaborative had planned to pay the $55 registration fee for four teachers, but only one teacher applied. The poor response was attributed to several factors, including teachers wanting to save their request to take time off work for the NCTM Regional Convention. The collaborative teacher who attended the workshop was very enthusiastic about her experience: "It was an excellent workshop. One of the best I have attended. Since the workshop, I have tried many of the small group activities and the students enjoyed them. I now feel more comfortable working with groups and have many good ideas in setting up groups. I also have a book of puzzles and new games to use in the classroom."

## Central Regional NCTM Conference

On October 27-29, 1988, the NCTM Central Regional Conference was held at the Clarion Hotel in St. Louis. The conference was extremely well attended, with more than 2,100 people participating. While the collaborative had agreed to pay the registration fees and substitutes' salaries for one teacher from each of the 17 high schools, only eight of the 16 teachers who registered were funded by the collaborative, as Title II funds paid for the teachers who were members of NCTM. Interested teachers were required to complete an application for funding in which they had to specify their reason for wanting to attend the conference and agree to write a short report following the conference. In addition, many of the collaborative teachers served as volunteers at the conference.

At 5 p.m. on the opening day of the conference, the collaborative sponsored an informal gathering to enable the teachers to meet with Dr. Mark Driscoll, Director of the UMC Technical Assistance Project. At the session, Dr. Driscoll highlighted the activities of some of the other collaboratives and also discussed their plans for permanence.

The teachers who attended the conference were very excited about what they had learned and the new teachers they had met. They were also most appreciative to the collaborative for providing the registration fees. One teacher commented, "I got a lot of ideas, lots of supplies. Most of all I enjoyed talking with other teachers from other areas and levels about their problems and teaching methods. I met so many interesting teachers from all over the U.S. . . . . The people you meet are the best part of these conventions." Another added, "I am a computer teacher. I was looking for ways to start a computer course. I would like to replace the first-year basic course with a new approach to computers. Many students never learn to program. I saw several demonstrations I think I can use to develop a new course. I also was able to talk with other teachers about their beginning course in computers." A third teacher said, "This was my first NCTM conference. I joined the NCTM. I feel that I can get something out of being a member. Several of the sessions were very good. I would like to thank the Math Collaborative for paying my way. I would not have attended had it not been for the collaborative." Another teacher added, "Thanks to the collaborative and Title II, I saw more St. Louis City teachers at this convention than ever before. This is very good for the public schools. I try to go as much as possible, but some teachers hardly ever get a chance to attend conferences. This was a very good conference."

### MSEC Seminar on Data Collection

The Mathematics Science Education Center sponsored an all-day seminar on February 16, 1989, on ways to use the computer and calculators as manipulatives. The seminar, "Activities for Data Collection with Calculators and Computers" was led by Dr. Katherine Pedersen of the Mathematics Department of Southern Illinois University in Carbondale.

The registration fee for the program, which was held at UM-St. Louis South Campus, was $55. The collaborative sponsored the attendance of one teacher at the seminar. The teacher enjoyed the workshop, reporting, "This workshop was a little different from some of the other computer workshops I have attended. I learned some new ways to get kids into problem solving. I thought it was very worthwhile."

### Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The St. Louis collaborative sponsored the attendance of four St. Louis mathematics teachers and the Council chairperson at the NCTM Convention in Orlando, Florida, April 12-15, 1989. The on-site observer also attended. Eligibility was open to all collaborative members. The Collaborative Council selected the recipients on the basis of their past contributions to, and overall interest in, the collaborative. The $300 awards were distributed by the Council upon receiving a short written report of the convention from each recipient.

The theme of the conference was "Vision for the World of School Mathematics." During the day the teachers attended a wide variety of sessions. In the evening, they participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Teaching and Curriculum Program.

The four teachers who received funding to attend the conference thought that the conference was informative, interesting and worthwhile. In the report submitted to the Council, one of the participants wrote, "Overall, the convention was interesting and enjoyable. I was able to talk with other conventioneers from different areas of the state and country. I enjoyed the exhibits and was able to gather materials to bring back to the classroom. I'm glad for the opportunity to attend another math convention. It seems to become more enjoyable and rewarding each time I attend."

## E. Observations

### Project Management

During the 1988-89 school year, the Collaborative Council continued to be central to the operations of the St. Louis Urban Mathematics Collaborative. Council members were more efficient and effective as the result of having developed a menu of activities during 1987-88. Through the course of the year, the Council sponsored two socials, a dinner symposium, a math fair and contest, two seminars, and a technology conference. This was accomplished primarily through the efforts of the 21 Council members and a few extra teachers who worked on the fair and contest committees.

Due to the numerous activities being planned, Council members had little time to address policy issues important for long-range planning, such as defining a direction and a vision, and developing strategies for increasing the number of active teacher participants and representatives from business and higher education. The need for a policy-making board to help with strategic planning is clear. Although this need was identified in 1987-

88 and the creation of such a board was approved by the Council in 1988-89, its formation was tabled until the process of developing a proposal for permanence has been completed.

The administrators of the collaborative, the director and teacher/chairperson, were both new in their positions and essentially were required to define their responsibilities as the year progressed. The experience in mathematics education that both the director and teacher/chairperson brought to their leadership roles was appreciated by the teachers. As one teacher said, "Helene helps me see the complete vision. She also is able to understand teachers."

The director and mathematics supervisors worked very closely in managing the business of the collaborative, but there were problems to overcome. First, because there was no transition period between the previous director's tenure and Dr. Sherman's, she was forced to learn through her own initiative, a process similar to the experience of a director when a new collaborative is being established. Second, there was no coordinator to assist Dr. Sherman. While Ms. Anita Madsen was elected as teacher/chairperson of the Council and did assume some of the responsibilities for collaborative administration, Ms. Madsen did not have the time to fulfill all the duties of a coordinator. Although the school district was contacted about the possibility of releasing a teacher to serve as collaborative coordinator, there was not sufficient time to arrange this for the 1988-89 school year; this possibility may be explored further in the permanence proposal. Third, in addition to operating the collaborative and ensuring its progress, Dr. Sherman was faced with the additional burden of completing work that was concerned largely with issues and events that had occurred prior to her arrival. This included an annual status report to the Ford Foundation and a report of expenditures for the duration of the collaborative. These extra pressures absorbed a great deal of her time during the first semester of the year.

It has been the Council's practice to appoint a committee when a new task is defined. As a result, several new committees have been formed and each Council member serves on a variety of committees. While this committee structure provides opportunities to draw greater numbers of teachers into collaborative participation, committee membership is now drawn primarily from the Council. This practice presents the potential danger of over-burdening these 13 teachers. In contrast, other collaboratives have established three or four standing committees, with each Council member serving on a single committee; as a new task is defined, it is assigned to the most appropriate standing committee. Whether the current committee structure in St. Louis fragments rather than facilitates the work is a question that merits further study.

Over the past year, the Ford Foundation and EDC have exerted pressure on the St. Louis Collaborative to spur the development of a sound permanence proposal. This pressure has resulted, in part, from a divergence in the conception of what the collaborative should be. Some teachers on the Council feel strongly that the collaborative should be teacher directed and should exist for the benefit of teachers and mathematics instruction in the district. This is a limited vision of the Ford Foundation's original intent for the collaboratives, which was to eradicate barriers between teachers and other mathematicians in business and higher education by providing opportunities for these groups to work together. It was the purpose of the UMC project to strengthen the organizational and community structures within which mathematics teachers function, so as to improve teachers' knowledge, resources and support.

The difference between the St. Louis collaborative's goals and the intent of the Ford Foundation is a matter of degree rather than substance. For example, the collaborative teachers view the mathematics fair and contest as important collaborative activities because they are planned by teachers and because they draw on businesses to provide financial resources. Both events were successful, benefitting students and providing activities that generated interest within the district. In terms of the overriding goals for the UMC project, these activities are significant because teachers who had not previously worked together were united in the context of the collaborative structure and learned about using resources in the community to further education. In this way, teachers took charge of improving their own environment. What is less clear is whether the mathematics contest and fair are viewed as isolated activities by teachers and the business community rather than as steps toward building a network for mathematics teachers and a strong community structure for the collaborative.

EDC intervened during the year to assist the collaborative in developing its permanence proposal because of the need to expand the number of groups represented in the process. It was EDC's purpose to help the collaborative develop a structure that builds more on business, higher education, and others in the community than does the current form of collaboration. The strategy EDC chose to use, which has been used successfully in another collaborative, was to identify someone to facilitate the process who is well linked and respected in the community and yet is an outsider to the collaborative. Dr. Hyram was hired by EDC to be this facilitator. Initially this intervention was viewed with chagrin by some teachers, who saw it as a means of circumventing their input into the decision-making process. Teachers on the Council met with Dr. Driscoll to clarify the process. Even after teachers had a chance to meet with Dr. Hyram in June, however, some teachers still had doubts about the process and felt that decisions were being made for them rather than in cooperation with them.

The Ford Foundation allowed the collaborative projects some latitude in terms of their individual development so that different models for collaboration would emerge. The St. Louis model that has developed is comprised primarily of a small core of teachers, who feel strong ownership in the collaborative's direction. While such a strong core of committed teachers may be beneficial, it is important to consider whether this small group of teachers is relatively exclusive and thus viewed negatively by their peers. One teacher who participated occasionally in collaborative activities commented, "Some of the collaborative members are very unfriendly and snobbish. They seem to feel more important than other teachers." This view is not shared by all, as indicated by another teacher's comments: ". . . The collaborative has provided several good opportunities for teachers to come together, to get acquainted, and to find out what is going on." It appears, however, that at least some teachers view the collaborative more as a "certain group of teachers" rather than something into which all teachers have input. This suggests that the benefits of a teacher-driven collaborative must be balanced against the need for a clear strategy for involving other sectors and a strong effort to ensure that all teachers feel at least some sense of ownership.

The St. Louis collaborative has had difficulty in generating a framework that is solidly grounded in the community and district. Because business and higher education have not been actively involved from the beginning, it has been difficult to draw them into the project as it matures.

## Collaboration

Collaboration is particularly strong among Council members, and it is beginning to develop among some other mathematics teachers as well. Teachers have noted that collaborative activities have helped them to become acquainted with their colleagues. One teacher commented, " [The collaborative] has provided useful and productive relationships. I have met teachers through both socials and workshops." Another teacher reinforced the impact of the socials: "The collaborative-sponsored socials and meetings were a means through which I was able to meet and get acquainted with teachers in other schools." In addition, the collaborative has enhanced collaboration between the mathematics supervisors and the teachers, in large part due to the involvement of the mathematics supervisors on the Council. When asked about the most significant changes that can be attributed to the collaborative, teachers have pointed to working closer with the mathematics supervisors. One teacher commented, "Teachers are working together with their supervisors to improve mathematics (instruction)." The collaborative also has enhanced teachers' access to district administrators, causing one teacher to observe that since her collaborative involvement, she had met with assistant superintendents to discuss important issues. Thus, the collaborative has helped to reduce isolation among some teachers and between teachers, the mathematics supervisors, and district administrators.

At least a few representatives from both business and higher education have been active on the Council, but in general, professionals from these sectors have served more as resources to make a presentation or to provide funding for an event rather than as cooperative participants in some project. The collaborative-sponsored seminars and symposia have presented speakers from higher education, and the socials have primarily involved teachers and administrators from the district with only two or three representatives from business and higher education. There has been some interaction across sectors that has given teachers opportunities to interact with people from business and higher education, but not to a great extent. When teachers have been asked about the impact of the collaborative, very few have mentioned any interaction with mathematicians from business and higher education.

When teachers are asked about in-school collaboration, responses reflect the difficulty the collaborative has experienced in increasing the number of teachers involved in its activities. When asked about the impact of the collaborative on the mathematics department in their school, teachers responded, "My department is not very active in the collaborative." Another teacher reported, "My department head is not very active in anything right now. She does distribute literature and give dates of meetings." The mathematics fair and contest have generated some participation among teachers and students. A teacher said, "I have seen little or no effect [on the mathematics department]. The collaborative was mentioned more during the math fair and contest than at any other time." Another teacher observed that the fair and contest have resulted in teachers "doing more" with their students. It appears that collaboration has been stronger among individual teachers from across schools in the district than it has been within departments.

**Professionalism**

The collaborative has increased teachers' participation in professional activities by informing them of conferences and providing financial support to encourage their attendance. When asked about ways the collaborative has affected how they view the curriculum, one teacher said, "The collaborative bulletins have made me more aware of available conferences and [the collaborative] has made funds available for fees. More teachers from my school have attended because of the collaborative." Another teacher responded, "Teachers in the collaborative have encouraged me to attend activities and improve my perspective."

In addition to encouraging teachers to attend conferences, it appears that the collaborative has been successful in its efforts to encourage teachers to join professional organizations. "The collaborative gave me the incentive to join and become an active member of math professional organizations [such as NCTM]," commented one teacher. Teachers who are active in the collaborative tend also to participate in other activities. As a district policy, teachers serve on curriculum committees; it is primarily collaborative teachers who serve on the mathematics curriculum committee.

In responding to interviews about the effect of the collaborative, a few teachers have said that the collaborative has resulted in more autonomy in decision-making and in some changes in their teaching. One teacher said, "I can finally see teachers doing things for themselves. I feel that through the collaborative I do have some voice in policy making. Even though it has been very little." This feeling is not shared by all teachers. Many feel that most decisions are made by the district. One teacher reported, "[The collaborative has had] very little [effect on my involvement in school-related decision making]. Most of these decisions are made citywide by the administration." In their teaching, some teachers have made a few changes that they can attribute to collaborative activities. As noted by a frequent collaborative participant, "The collaborative has enhanced my teaching by allowing me to see new approaches and new technologies and to network with other mathematicians to obtain additional ideas."

In 1988-89, for the first time, the collaborative sponsored a Teacher-of-the-Year Award for a mathematics teacher. The award was very well received by teachers accustomed to working in an environment with little positive external recognition. Similarly, other collaborative activities have prompted St. Louis mathematics teachers to become more professionally involved and excited. One problem that has yet to be solved is how to increase the number of teachers who are active in the collaborative. Clearly, the collaborative is reaching some teachers, but it has not yet developed a critical mass of teachers and other community representatives and a well-defined set of activities in order to assure that the collaborative has an identity of its own that extends beyond the few who serve on the Council. Stability in leadership is essential if this is to happen. Furthermore, there must be a greater effort to instill in all St. Louis Public School secondary mathematics teachers a sense that the collaborative is an organization for each of them.

## Mathematics Focus

During the 1988-89 school year, the district adopted new textbooks and implemented a new curriculum in its high school mathematics classes so that the curriculum would correspond more closely with current recommendations for mathematics education. These recommendations include the increased use of technology in the teaching of mathematics and efforts to have all students take algebra. To a large degree, the collaborative focused on implementing the new curriculum. The collaborative helped to plan the technology conference and tried to get teachers to network with one another by organizing subject area study groups. The technology conference, which was funded by Title II, was well attended, but attendance at the five study groups was very low. Teachers have expressed frustration in implementing the new curriculum. One teacher explained that having new textbooks in all subjects was too much to digest at one time. Another teacher complained that the new curriculum also requires new teaching techniques.

The collaborative sponsored two seminars and a dinner symposium that focused on mathematics reform in other countries. One program addressed what is happening in England with regard to problem solving, another contrasted the Hungarian curriculum with what is used in the United States, while at the third, the alternative forms of assessment being used in the Netherlands were discussed. All three of these programs were very well received. These presentations, as well as prior collaborative activities, have acquainted mathematics teachers with what is going on in other places and have helped to broaden the teachers' perspectives of mathematics. One teacher noted, "I am able to keep up with modern trends and techniques of teaching mathematics. The workshops I have attended have increased my knowledge of mathematics." Another teacher observed, "[The collaborative] keeps me focused on national goals -- rather than my own goals [so] ... I ... [can] provide more efficient and effective teaching..."

Teachers in St. Louis have been exposed to changes in the curriculum and are aware of the trend towards increased use of calculators, manipulatives, and games in the classroom. In three of four classes observed during a site visit to a school, students used calculators as a regular part of their classroom work. Students also spent time working in pairs and small groups. The major shift in curriculum has made it difficult to identify the role of the collaborative. What is of note is that the mathematics supervisors see the collaborative as contributing to the implementation of the curriculum by providing teachers with experiences supportive of the direction being taken by the district. Through collaborative activities, teachers are being exposed to current trends. When five teachers were asked about the collaborative's role in keeping them current, all answered that the collaborative has helped by either enabling them to attend a conference or through the seminars it has sponsored. Although there are still administrative issues to be solved by the collaborative, teachers are benefitting from the collaborative. Its activities, at a minimum, provide an awareness of nationally recommended changes in mathematics education.

## F. Next Steps

The St. Louis Urban Mathematics Collaborative will work through the summer of 1989 and into the school year developing a proposal for permanence. Future activities and the administrative structure for the collaborative will be defined through this process. In August, the collaborative will sponsor computer workshops taught by two collaborative teachers. A "Welcome to the New School Year" picnic is scheduled for September. Planning is already underway for the third mathematics fair and contest, which will be planned and directed by committees of teachers. On July 4, 1989, the collaborative will contribute to a display of the Mathematics Science Center at the Veiled Prophet Fair, a St. Louis tradition. Interviews for the position of collaborative director were conducted in late July. Jerome Burke, formerly a mathematics supervisor for the St. Louis Public Schools and an active member of the Collaborative Council, was selected to be the new collaborative director and will assume the position as of August 1, 1989.

# SUMMARY REPORT:
# SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the San Diego Urban Mathematics Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal for funding submitted by the San Diego Urban Mathematics Collaborative to the Ford Foundation; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM Conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; and three site visits by the staff of the Documentation Project.

# SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

## A. Purpose

The purpose of the San Diego Urban Mathematics Collaborative is to improve the professional lives of teachers in the San Diego area by reducing their tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community. The collaborative has identified two long-term goals that it would like to see adopted by the local school districts and supported by community resources. The first is to provide teachers with opportunities to continue their education, either formally (i.e., through university courses) or informally (i.e., through conferences). The second goal is to foster the active participation of more teachers in the Greater San Diego Mathematics Council and to use the GSDMC as a vehicle through which teachers can organize and promote their own professional activities. Additional goals, established during 1987-88, are to promote the development of leadership skills among teachers and encourage teacher initiatives within their classrooms and school sites.

## B. Context

The San Diego Urban Mathematics Collaborative (SDUMC) serves the mathematics teachers in both the San Diego Unified School and the Sweetwater Union High School districts. Although these two districts are in relatively close geographic proximity to each other, each is unique in terms of the social and demographic context in which the collaborative must operate.

### The San Diego Unified School District

The city of San Diego has a population of approximately 900,000 and is surrounded by a metropolitan area of about 2 million residents. The population is expected to increase by approximately 2.3 percent per year over the next ten years, in large part because of the ongoing immigration of ethnic minorities. Current census figures indicate that approximately 25 percent of San Diego County's population is comprised of minorities, but this estimate is probably low as a large number of county residents are Mexican immigrants who have entered the country since the last census. Although the primary economic bases of the county are tourism, defense contracting (including a large naval base) and manufacturing, companies specializing in high technology have flocked to the area, creating the need for a more skilled labor force.

The San Diego Unified School District's (SDUSD) 152 schools serve approximately 119,000 students. The district has 106 elementary schools (grades K-6), eight middle schools (grades 6-7, 7-8 or 6-8), twelve junior high schools (grades 7, 7-8, or 7-9), fifteen senior high schools (grades 9-12 or 10-12), six schools for the handicapped, three multi-grade specialty schools (one Creative and Performing Arts grades 4-12, one Mathematics, Science and Computers grades 7-12, and one Alternative K-12) and two continuation schools. In addition, the district operates 27 children's centers and preschools for three- and four-year-olds at 22 school sites.

Thirty-four of the elementary schools (grades K-6) and 13 of the secondary schools (grades 7-12) are magnet schools. Two other magnet schools combine elementary and secondary students. Magnet schools are designed to offer concentrated instruction in several specialized fields of study in addition to basic curriculum. Secondary magnet programs include business administration, creative and performing arts, and mathematics and science.

Of the total student population, 51 percent are male and 49 percent are female. Approximately 42 percent of students are white, 23 percent are Hispanic, 19 percent are Asian and 16 percent are black. Fifteen percent of SDUSD students consider English a second language. Twenty percent of students' families receive AFDC, and 41 percent are eligible for federally funded lunch programs. Enrollment is increasing, with Asian students representing the largest percentage increase in the last six years, from 15 percent to 19 percent. Hispanics showed the second largest percentage increase, from 19.6 percent to 23 percent in the same time period. In contrast, the percentage of white students in the district has decreased from 49 percent to 41 percent since 1983.

Approximately 8,000 middle school students are enrolled in the SDUSD. Fifty-one percent are male, and 49 percent are female. Forty percent of middle school students are white, 23 percent are Hispanic, 18 percent are black, 18 percent are Asian and less than 1 percent are American Indian. Thirteen percent speak English as a second language, and 52 percent are eligible for federally funded lunch programs.

In total, 13,000 seventh, eighth and ninth grade students attend SDUSD junior high schools. Approximately 52 percent of the students are males and 48 percent are females. Forty-three percent are white, 23 percent are Hispanic, 22 percent are Asian and 12 percent are black. Twelve percent of junior high students consider English a second language, and 35 percent qualify for federally funded lunches.

Of the 24,500 senior high school students in SDUSD schools, 51 percent are males and 49 percent are females. Forty-five percent are white, 20 percent are Asian, 19 percent are Hispanic, 15 percent are black, and 1 percent are of other ethnic backgrounds. Ten percent of the student population consider English a second language, and 20 percent receive federally funded lunch support.

Approximately 27,000 students in grades 9-12 are enrolled in mathematics courses each semester. Fifty-one percent of these students are male and 49 percent are female. Twenty-eight percent of mathematics students are in the ninth grade, 27 percent are in the tenth grade, 27 percent are in the eleventh grade and 18 percent are in the twelfth grade. Forty-six percent of students enrolled in mathematics are white, 21 percent are Asian, 18 percent are Hispanic and 15 percent are black. Graduation requirements include six semester units of mathematics, as well as demonstrated proficiency in a series of examinations. A new core curriculum that requires all secondary students to take college preparatory courses in basic subject areas, including algebra, was approved in 1988 and is currently being phased in.

In fall, 1988, SDUSD eleventh graders' scores on the Comprehensive Test of Basic Skills equalled or exceeded the national norm in all ten subtest areas. Seventy-three percent of SDUSD eleventh graders scored above the national average on the CTBS on the combined mathematics scales. In 1987, seniors who took the Scholastic Aptitude Test (SAT) achieved mean scores of 423 on the verbal scale and 485 on the mathematics scale, as compared with national norms of 430 and 476, respectively.

Thirty-six of every 100 ninth graders in the San Diego Unified School District will drop out before graduating. A dropout is defined by the state of California as any student in grade 10, 11 or 12 who departed from school before graduation or completion of formal education (or its legal equivalent), and is not known to have returned to any school or educational program by mid-October of the following school year. Sixty-nine percent of SDUSD high school graduates go on to post-secondary education in the year following high school graduation.

More than 180 students from the SDUSD participated in the final year of a four-year test of the Summer Training Education Program (STEP). Participating students came from low-income families and performed at least one grade level behind in reading or mathematics. The STEP program includes two summer school/work sessions, before and after the regular school year, and counseling during the fall and spring semesters. Students earn approximately $1,000 for the seven-week program. Results indicate that STEP students dramatically outperform students who are employed but not enrolled in summer school.

SDUSD high schools employ 1,400 teachers. Fifty-five percent are male and 45 percent are female. Eighty-one percent of high school teachers are white, 8 percent are black, 7 percent are Hispanic, 2 percent are Asian and 2 percent are American Indian. Of the 227 instructors who teach mathematics, including 12 San Diego Community College instructors who teach calculus, 57 are female, and 170 are male. Approximately 87 percent of SDUSD mathematics teachers are white, 4 percent are Asian, 4 percent are Hispanic, 4 percent are black and 2 percent are American Indian. Seventy percent of high school mathematics instructors hold at least a master's degree, and 98 percent have earned at least a bachelor's degree. All mathematics teachers are certified to teach in their subject area. Ninety-one percent are tenured.

The average teacher salary in the SDUSD is approximately $36,000 per year. Sixty-four percent of SDUSD teachers belong to the teachers' union, The San Diego Teachers' Association. In November, 1988, teachers negotiated a new four-year contract that included a 2.5 percent raise on the schedule and a .5 percent bonus off the schedule. The contract addressed educational reform issues such as the involvement of faculty in decision-making proceedings and budget development, and established district policies regarding peer coaching, and observation and team performance reviews. State Superintendent of Schools Bill Honig was instrumental in the negotiations that finally produced the settlement. All of the participants on both sides agreed that continued disputes would be detrimental to a state initiative for generating more school funds. Official contract renewal dates and stipulations will be contingent upon recommendations from a fact-finding committee. As a result of contract negotiations, entry-level salaries for SDUSD teachers start at $23,832 for a nine-month contract and increase to a maximum of $46,021 for teachers with a master's degree and 90 semester hours.

The SDUSD's 1988-89 budget totalled $521 million. Eighty-five percent of budget funds comes from state and local sources, 11 percent originates from outside funding and only 4 percent of total revenues is received from the federal government. Per-pupil expenditures for 1988-89 averaged $3,965 per student. The projected budget for the 1989-90 school year is $575 million. A major issue facing the district is its increasing student enrollment in light of inadequate school facilities.

## The Sweetwater Union High School District

The Sweetwater Union High School District (SUHSD) serves the city of Chula Vista and its surrounding area. Chula Vista is the southernmost city in the San Diego urban area, situated only four miles from the U.S./Mexican border. The area is comprised of a mixture of residential, commercial and industrial regions. The 147,000 residents are primarily low income.

The district's 20 schools include two middle schools (grades 7-8), two middle/junior high magnet schools, seven junior high schools (grades 7-9), one junior/senior high magnet school, and eight senior high schools (two grades 9-12 and six grades 10-12). Seven schools (two middle/junior high schools, four senior high schools and one junior/senior high school) in the district are designated as magnet schools. The magnet programs include: computer science; mathematics, science and computers; business; language; college preparation; and creative and performing arts. One of the junior high magnets, the NOVA+ program, emphasizes analysis, discussion and composition as they relate to four academic areas: English, mathematics, science and social science.

A total of 27,000 students are enrolled in the Sweetwater Union High School District. Of these, 52 percent are Hispanic, 29 percent are white, 11 percent are Filipino, 4 percent are black, 3 percent are Asian/non-Filipino, and 1 percent is American Indian. The percentage of minority students has risen from approximately 50 percent in 1978 to 71 percent in 1988, with Hispanics showing the largest percentage increase (16 percent). Enrollment has increased over the same time period, from 22,000 students in 1978 to the current total of 27,000 students. Thirty percent of the student population is eligible for federally funded lunch programs. The district includes three vocational education and adult education centers that enroll nearly 4,000 students.

Thirteen percent of the SUHSD student population consider English a second language. With the influx of limited English proficiency (LEP) students to the district, Sweetwater continues to face the issue of a shortage of bilingual mathematics and science teachers.

In total, 2,300 students are enrolled in the district's middle schools (grades 7-8) and 7,600 are enrolled in the junior high schools (grades 7-9). Fifty-two percent of the combined middle/junior high school student population are Hispanic, 29 percent are white, 11 percent are Filipino, 4 percent are black, 3 percent are Asian/non-Filipino and 1 percent is American Indian. Approximately 17 percent of the junior high students consider English a second language.

The SUHSD enrolls 13,000 senior high school students. Of these, 53 percent are Hispanic, 31 percent are white, 9 percent are Filipino, 4 percent are black, 2 percent are Asian/non-Filipino and 1 percent is American Indian. Sixteen percent of Sweetwater high school students consider English a second language. On the average, students in the district scored above the national average on the Comprehensive Test of Basic Skills. Although 50 percent of high school graduates go on to post-secondary education, the cumulative dropout rate for Sweetwater schools is nearly 30 percent. Graduation requirements include three years of mathematics.

Approximately 1,100 teachers are employed by the district. Of these, 52 percent are female and 48 percent are male. Seventy-eight percent of Sweetwater teachers are white, 16 percent are Hispanic, 2 percent are black, 1 percent is Filipino, 1 percent is Asian/non-Filipino, and approximately 2 percent are from other ethnic origins. All Sweetwater teachers belong to a teachers' union. The current teachers' contract was approved in 1985 and is in effect until June 30, 1989. All teachers receive four paid release days for in-service and other teacher-training purposes. All of the teachers have earned at least a bachelor's degree.

The district's general fund expenditures for the 1986-87 school year totalled approximately $102 million, while the 1987-88 budget totalled approximately $106 million. The state of California provides approximately 70-75 percent of the total monies allocated to the district. The federal government provides 5-6 percent of the Sweetwater budget, and the remainder comes from local revenues.

Anthony J. Trujillo, superintendent of the Sweetwater Union High School District, came to the district four years ago from Marin County, California, one of the most affluent districts in the nation. One of his major goals has been to improve teaching, and he plays an active role in overseeing classroom instruction.

During the 1987-88 school year, the SUHSD initiated a major staff development program entitled "Writing Across the Curriculum/Writing to Learn in Math." Half of the district's schools received at least seven days of training in order to assist teachers as they worked to develop a grasp on implementing the writing component of the California Mathematics Framework. In addition to the program's value as teacher training, writing activities help students to increase their ability to conceptualize and retrieve information. The district continued the project well into the 1988-89 school year through in-service training.

In the face of a total of 1.3 million student absences during the spring of 1988, the SUHSD Board established a policy to restrict teacher release time on the assumption that teacher absences to attend workshops and conferences tended to aggravate the problem. Sweetwater teachers were encouraged to develop creative alternatives to continue their participation in UMC activities without taking time from their classroom schedules; however, the policy was set aside in the middle of the 1988-89 school year.

Sweetwater High School and National City Junior High School, both of which are collaborative schools, are planning to go to a year-round schedule starting in June, 1989, in hopes of retaining more students in school. Four school sessions, each nine weeks long, will be divided by breaks of three, four, six, and three weeks. A schedule of intersession classes will be offered during the session breaks.

### Additional Information

The proximity of two universities that place a high priority on mathematics education, San Diego State University and the University of California-San Diego, helps foster a positive environment for the collaborative. The University of California-San Diego sponsors an annual Mathematics Teacher Institute, which consists of both a summer program and a one-year academic program. Activities are designed to strengthen school teams and to build a sense of mathematics community. In 1988, two collaborative teachers taught at the Institute, while two others were enrolled as participants. Approximately 50 high school mathematics teachers from the San Diego and Imperial counties will be selected for the 1989 Summer Institute. The University of California-San Diego will pay participating teachers a stipend of $1,200 for the summer session and a $400 stipend at the end of the academic year program. In addition, participants will receive textbooks, classroom supplies and ten units of UCSD credit.

Frank Holmes, a member of the SDUMC Executive Committee and director of the minority engineering program at San Diego State University, has been awarded a $430,000 NSF grant to fund a minority mathematics enrichment program, the first of its kind in the nation. The program, the San Diego Math Science Enrichment Project, targets Hispanic and black second- and third-grade students to ensure that they have requisite skills to advance into higher mathematics courses. The 8:1 student-teacher ratio is the key to the program's success. While the curriculum focuses on concept acquisition and integration, the program is designed to enhance the skills and enthusiasm of elementary mathematics teachers.

San Diego State University, in collaboration with the San Diego County Office of Education, sponsored the San Diego Mathematics Project, a leadership program for teachers of mathematics in grades K-12. Components of the program include three weeks of summer in-service that focuses on current issues in mathematics, a weekend retreat in the fall, and periodic meetings throughout the academic year. Participating teachers received a $500 stipend and expenses for the fall retreat, as well as books and other educational materials. San Diego State professor Nick Branca, a member of the collaborative's Executive Committee, directs the San Diego Mathematics Project.

The Center for Research in Mathematics and Science Education (CRMSE) at San Diego State University offered a colloquium series during the 1988-89 school year. The series featured speakers from around the country who addressed key issues related to science and mathematics education. The colloquia, which were held at 3:30 Friday afternoons, were open to all science and mathematics teachers in the area.

The San Diego Compact is the educational fund for the area. The SDUSD appointed Jeanne Jehl, an administrator on special assignment from the office of the deputy superintendent, to work with the Compact. The Compact sponsored a conference on the dropout problem in December, 1988.

A wide variety of professional organizations serve the mathematics teachers in the San Diego area. The Greater San Diego Mathematics Council (GSDMC), an 800-member affiliate of the National Council of Teachers of Mathematics and of the California Mathematics Council, sponsors several special events during the year. At the beginning of the 1988-89 school year, the collaborative was asked to appoint a representative to serve on the board of the Greater San Diego Mathematics Council. This is an important development, in that it indicates that the SDUMC has been recognized as a viable member of the professional mathematics community in San Diego. Rodene Gosselin, a teacher at Sweetwater High School, served as the SDUMC representative. Area mathematics teachers also can join the California Mathematics Council, which sponsors an annual meeting in November for members living in southern California.

Each year the Greater San Diego Mathematics Council and the California Mathematics Council-Southern Section, in cooperation with San Diego State University and the local community colleges, sponsor a Senior High School Mathematics Field Day and a Junior High Mathematics Field Day. The 26th annual Senior High School Mathematics Field Day was held at San Diego State University on February 25, 1989. High schools from San Diego County were eligible to enter ten contestants for individual and team competition. The variety of events challenged students to solve problems, work through mathematical logic, use calculators efficiently, and demonstrate other mathematics skills. The events, designed to be both fun and challenging, were created by members of the professional mathematics community in the San Diego area.

The 21st annual Junior High Math Field Day was held May 13, 1989, at Bell Junior High School. Competitions were divided into team and individual events, with separate categories for schools with grades 7-9 and schools with grades 7-8. Mathematics events included problem solving, terminology, math wits, and mathematical games.

Granger Junior High School, one of the collaborative's target schools, won a State of California Demonstration Grant to enhance its language arts and mathematics programs. The school will receive $150,000 over a three-year period.

In the Spring semester of 1989, 50 tenth grade "at-risk" students at Morse High School, a collaborative school, will establish the Partnership Academy Program. This school-within-a-school will focus on computer repair and computer business applications. Students will be placed in a summer work experience during their junior and senior years. Besides being assigned to three core subjects (science, mathematics and English), the students' curriculum will include computer literacy, career development, job training skills, job interview practice, visits to work sites, and guest speakers. Upon completion of their senior year at Morse, students will be certified as Level One Apple Technicians. The mathematics and computer literacy courses will be taught by an SDUMC teacher.

## C. Development of the Collaborative

The collaborative leadership in 1988-89 continued to be provided by Director Alma Marosz and Co-director Dr. Mary Koehler of the Department of Mathematical Sciences at San Diego State University. The co-directors' duties were divided such that Ms. Marosz assumed the lead role while Dr. Koehler provided backup and support. Coordination of the collaborative was divided between Dr. Frank Holmes, Director of Minorities Programs at San Diego State University College of Engineering, and Jean Childs-Moore. Ms. Childs-Moore resigned as SDUMC coordinator in March and was succeeded on April 6, 1989, by Dr. Barbara Wyman. Dr. Wyman, who earned a doctorate from Harvard University, has had a wide range of educational experiences, including teaching in both elementary and secondary schools. Dr. Holmes continued to serve as a liaison among the project staff, the community, and the site administrators at the SDUSD target schools. Ms. Childs-Moore had served as the principal liaison between the collaborative and the administration of the Sweetwater Union High School District, coordinated and helped plan activities, and maintained communications among collaborative members. In April, these duties were assumed by Dr. Wyman. The collaborative office is located in the same building as the Center for Research in Mathematics and Science Education (CRMSE), and the collaborative shares a secretary with the CRMSE staff. The on-site observer is Dr. Sharon Whitehurst, the Affirmative Action Program Administrator for the San Diego Unified School District.

### Executive Committee

The collaborative's decision-making body is its 22-member Executive Committee. Members of the committee include 11 teachers who represent the nine target schools; two administrators from the San Diego City Schools; one administrator from the Sweetwater Union High School District; one representative from the County Department of Education; three mathematics education faculty members from San Diego State University; and the four collaborative administrators. The Executive Committee held ten monthly meetings during the school year, with sites rotating among the target schools. Attendance at the meetings ranged from 12 to 18, with an average of 14 Executive Committee members at each meeting. Sometimes members who were unable to attend sent a representative or proxy. Minutes of the Executive Committee are distributed to all collaborative members.

The Executive Committee's responsibilities evolved during the year. Initially, the committee served as a liaison between the collaborative and its members, distributing information to teachers and gaining their input into the decision-making process. Early meetings were chaired by the director; topics included the attendance of teachers at the NCTM Annual meeting in Orlando and the need for teachers to apply early to their districts for release time; the relationship of the collaborative to the Greater San Diego Mathematics Council (GSDMC); and the types of workshops teachers found interesting and whether a stipend was necessary to promote workshop attendance. Teacher representatives from each of the nine target schools relayed the views of the teachers at their individual schools.

As the school year progressed, the Executive Committee's attention turned to the process of developing a permanence proposal. At the December meeting, the committee established a subgroup to plan a March retreat at Lake Arrowhead that would focus on permanence and the future goals of the collaborative. The retreat planning committee, which was comprised of five teachers, including the chair and co-chair of the Executive Committee, reported on the plans for the retreat and sought input at the January and February Executive Committee meetings. At the February meeting, the Executive Committee decided that one teacher from each district would be selected by peer review to attend the EDC August Leadership Conference.

At the March Lake Arrowhead retreat, the five-member Planning Committee drafted a document that defined the goals, objectives, and organization of the Executive Committee, and proposed a restructuring of the group. The proposal, which stipulated that a teacher should chair the meetings, was adopted in March. At the same meeting, the Executive Committee assigned to the Planning Committee responsibility for selecting the teachers who would attend the Teacher Leadership Conference from among those who volunteered. The Executive Committee also agreed that a chair, co-chair, and secretary would be elected at the April meeting; that by-laws would be written; and that departments would be asked to review the draft document that had been prepared at the retreat.

At the April meeting of the Executive Committee, the name of the decision-making group was changed to the Executive Board. Three committees were formed: the Nominating Committee, to nominate the officers and define their duties; the By-Laws Committee, charged with developing the rules under which the Executive Committee would operate; and the Activities Committee, responsible for planning activities for the upcoming school year. The Activities Committee developed a survey for distribution to all collaborative teachers requesting their input about activities and events.

In May, Andy Ashcraft, a teacher at Lincoln Preparatory High School, was elected chair of the Executive Board and Ron Tsui, a teacher at Bell Junior High School, was elected co-chair. Dr. Arthur Ellis, a consultant hired by EDC to direct efforts to include parents and representatives of business in the collaborative, also attended the meeting. Dr. Ellis is a faculty member of the School of Social Work at San Diego State University. The meeting included a discussion of how the collaborative could incorporate additional community resources.

At the Executive Board's June meeting, the final meeting for the school year, the Activities Committee reported results of its survey, and a Budget Analysis Committee was established to analyze the cost of the activities. At the meeting, plans for the first community and business breakfast, scheduled for June 26, were discussed.

**Target Schools**

The collaborative's nine target schools remained the same in 1988-89 as they had been in 1987-88. They included three high schools and two junior high schools from the San Diego Unified School District, and two high schools and two junior high schools from the Sweetwater Union High School District. The target schools in the San Diego Unified School District were Morse High School, Lincoln Preparatory School, San Diego High School, Bell Junior High School, and Keiller Middle School. The target schools in the Sweetwater Union High School District were Sweetwater High School, Mar Vista High School, National City Junior High School, and Granger Junior High School. The collaborative had planned to expand at the end of the 1987-88 school year to include all of the feeder junior high schools that serve the five collaborative high schools, but the extended illness of one of the coordinators made this expansion impossible.

## Planning for Permanence

During the 1988-89 school year, the collaborative began to prepare a permanence proposal for submission to the Ford Foundation. As has been noted, teachers had discussed the issue of permanence at the Fall Executive Committee meetings, and the committee also began to develop plans for the March Lake Arrowhead Retreat, which was to focus on permanence. In February, 1989, Barbara Scott Nelson, project monitor from the Ford Foundation, wrote to the collaborative director to express concern about the collaborative's readiness to submit a permanence proposal by June, 1989. It was Dr. Nelson's concern that the collaborative may not have been able to develop a strategy within a time frame that allowed teachers to exercise initiative in planning and developing activities and that fully engaged other resources from the business community, the school districts, and other forums of mathematics education. Dr. Nelson offered to extend the proposal submission date to September, 1989, or June, 1990, but the extension did not include additional funds. She offered the assistance of the Educational Development Center to help the collaborative to develop a viable strategy.

The Lake Arrowhead Retreat Planning Committee met during the two-day retreat to develop guidelines for the administrative structure of the collaborative. It based its planning on input it had received from retreat participants during discussions held the first day of the retreat. Committee members prepared a draft document that presented the goals, objectives, and organizational structure of the collaborative; in April, the Executive Committee approved the document and directed that it be distributed to all collaborative teachers for their input. The goals identified in this document included: providing collegiality and opportunities for professional development; fostering a sense of support among members of the mathematics community for a collaborative effort that would serve as a power base for effecting change; promoting professionalism and excellence among mathematics educators; developing leadership within the local mathematics education community; and continuing to promote equity. This document led to the restructuring of the Executive Committee into a Board that has elected officers, by-laws, and standing committees.

EDC provided ongoing support as the collaborative developed its proposal for permanence. Brian Lord, Director of the Outreach Project, made a presentation at the March Lake Arrowhead Retreat. In April, EDC provided the funds to hire Professor Arthur Ellis of the SDSU School of Social Work as a consultant to help increase community participation in the development of the permanence plan. Professor Ellis, members of the EDC and collaborative staffs, and the five teachers from the Planning Committee met in May and June to plan and coordinate their efforts.

A breakfast meeting designed to inform key people from the community about the collaborative was held June 26, 1989. More than 30 people attended the 7:30 a.m. meeting at the Doubletree Hotel in Mission Valley. Participants included six teachers, the four collaborative administrators, three school administrators, three current and former school board members, ten representatives from business and the military, four from higher education, two PTA representatives, and the on-site observer. The purpose of the meeting was to acquaint participants with the goals and activities of the collaborative and to solicit their support and involvement; participants' response was very favorable.

## D. Project Activities

In addition to encouraging teachers to take advantage of the wide array of opportunities for professional development offered by local resources, the collaborative sponsored several events of its own. The collaborative also provided funding for teachers to attend regional and national workshops and conferences.

### Collaborative Workshops

#### Contemporary Topics in Mathematics using Technology

The collaborative and the SDUSD co-sponsored the workshop "Contemporary Topics in Mathematics using Technology" at Morse High School, from 9 a.m. to 4 p.m., August 29-September 2, 1988. The workshop was designed to introduce teachers to the new curriculum material developed at the North Carolina School for Science and Mathematics (NCSSM) and to demonstrate how calculators and computer software can be used to teach mathematical concepts. The workshop was coordinated by

Collaborative Director Alma Marosz and taught by SDUSD teacher Brian Macky. In addition, two members of the Los Angeles UMC +PLUS+ Project participated as instructors for one day. SDUSD provided partial funding. Seventeen teachers, including 11 collaborative teachers, attended the week-long workshop. Each participant received a stipend paid by NCSSM through an NSF grant.

While some of the participants felt that the workshop topics were too advanced for their students or not applicable to teachers who did not have access to calculators, computers and/or software featured in the activities, most respondents said the workshop was beneficial. In particular, many seemed to appreciate the opportunity to interact with their colleagues and to share ideas and information.

The on-site observer reported, "The teachers received something valuable from the workshop and felt that it was a worthwhile endeavor." On the written evaluation form, one teacher wrote, "To me, this type of subject-oriented gathering of math instructors is much more helpful than staff development I have experienced. I would like to have an in-service on the use of the new calculators available in the city schools." Another teacher said, "I found most of the material interesting even if not applicable to my grade level (7-9), and I will be able to use some for general interest. Perfect justification for calculators in the classroom." A third teacher wrote, "Although I did find the in-service somewhat useful, I could use only some of the ideas presented because most of the topics discussed were too advanced for the average algebra and geometry students I teach. I feel the workshop would have been more beneficial if we broke up into smaller groups . . ." Several teachers wrote that they felt that the Casio Graphing Calculator should be available to students on a daily basis.

## Small Group Cooperative Learning in Mathematics: A Variety of Strategies

On Tuesday, September 20, 1988, the collaborative sponsored an all-day workshop on cooperative learning strategies for teachers in the target schools. Professor Neil Davidson of the University of Maryland at College Park presented a wide variety of strategies specific to mathematics instruction and cooperative learning groups. Collaborative members who had attended Professor Davidson's session at the National Council of Teachers of Mathematics 1988 Annual Conference recommended that the collaborative offer the workshop.

Twenty-three teachers attended the event, which was held from 8:30 a.m. to 3:30 p.m. at the Hyatt Islandia Martin Club. Participants said the workshop was very helpful. One teacher commented, "It was excellent. One of the few workshops where I got something that I can use." Another added, "I found it useful. The cooperative learning workshop was helpful." A third teacher said, "The speaker was very knowledgeable about his topic. He appeared to have worked with students and had answers . . . ." The on-site observer reported, "The participants received a lot from this workshop. It was one of the more useful workshops for them."

## California Mathematics Framework Workshop Series

For the second year, the collaborative offered a Saturday morning workshop series to address topics related to the California Mathematics Framework, which is the guideline for K-12 mathematics education in the State of California. The workshops were held from 9 a.m. to 1 p.m. on February 25, April 29, May 6, and May 20. In three of the workshops, teachers had the option of receiving a $50 stipend or district-approved hurdle credit. For the April workshop, Casio FXGS7000 graphic calculators were distributed to participants in lieu of the stipend.

Operation and Computer Skills. Fourteen teachers attended the first of the workshops, which was held February 25 at National City Junior High. The workshop focused on familiarizing participants with computer software that is currently available. Milo Hallack and Kathy Lathus, both collaborative teachers, led the session.

Participants reported that the workshop was informative and that the hands-on approach was extremely useful. All but one of the 12 teachers who completed the written evaluation form rated the overall workshop, its objectives, and the usefulness of the ideas and activities presented as a 4 or 5 on a 5-point scale (with 5 representing "excellent").

Many teachers felt that the strongest feature of the workshop was the chance to investigate and review a variety of computer software and to "practice" with specific programs. One teacher wrote, "I look forward to these workshops and am greatly appreciative of the work and time put in by the people to make all this possible." The teachers appeared to be highly motivated by the opportunity to review the software, and a few participants requested more exposure to specific programs: "I still would like to see some demonstrations of effective use of PC Viewer in classroom teaching--although, after today I have more ideas," and, "I was interested in seeing the PC Viewer--would like to investigate the use of other manufacturers' products--such as: Sharp Projection System/Kodak Data System, etc."

Graphic Calculators. On April 29, Brian Macky, a SDUSD teachers, presented the second workshop in the series, "Graphic Calculators." Response to the workshop was so positive that the collaborative established a waiting list. In all, 39 collaborative teachers attended the Saturday morning session, which was held at National City Junior High.

Participants rated the workshop very high in terms of benefit, clarity of objectives, and pertinence of the ideas, with all but three of the 39 teachers rating these categories a 4 or 5 on a 5-point scale on the written evaluation form. Many teachers commented that it was helpful to have the hands-on experience and their own calculators to work with. Asked to specify a strong feature of the workshop, one teacher wrote, "This calculator will help me to visualize certain functions. I am a 'visual' person and need this for comprehension." Another mentioned, "Brian's extensive knowledge of subject and good communication skills. He was very well prepared." A third wrote, "The calculator and presentation--an eye opener!" Several participants wrote that they felt a follow-up workshop would be very beneficial.

The on-site observer reported: "The teachers were really excited about receiving this calculator. This was one of the best attendances the collaborative has experienced. They preferred the calculator to receiving the stipend. That's impressive!"

Geometric Supposer. On May 6, 15 teachers attended the third workshop in the series, which focused on the use of the Geometric Supposer. Renee Harris, a teacher at Granger High School and a workshop leader in the 1987-88 workshop series, conducted the session. During the workshop, Ms. Harris incorporated part of the presentation that she had seen Richard Houde give at the Conference on Computers at Phillips Exeter.

Participants indicated that the workshop was valuable. Of the ten teachers who returned evaluation forms, all but one rated the workshop 5 on a 5-point scale in terms of overall value, objectives, and the usefulness of the ideas and activities presented. Teachers' comments also were very favorable. Several teachers praised the "hands-on" aspect of the workshop. One teacher wrote that the workshop was, "well organized and [provided] useful hints for class activities." Other comments included: "Well organized and useful hints for class activities"; and "This is pretty advanced for my grade level but I will keep it for future reference if I teach geometry." One teacher commented on her attendance at collaborative activities, remarking, "Sometimes it's difficult to commit to activities, but they've always been good." The on-site observer reported, "This workshop attracted some participants who had not attended a similar workshop on computers or with the Geometric Supposer."

Cooperative Learning. The fourth and final workshop in the series was held May 20 at Sweetwater High School and was led by collaborative teachers Rodene Gosselin and Athalean Gee. The workshop, which was limited to the first 15 teachers to apply, focused on alternative teaching strategies with an emphasis on cooperative learning.

The teachers felt that the workshop was very good, with most teachers rating it 5 on a 5-point scale on the evaluation form distributed by the collaborative. Along with several short comments of "Excellent" or "Good Presentation," written comments included, "I learned many new ideas to use cooperative learning to increase interest and motivation in the student"; "I'm a reluctant acceptor of the cooperative learning format. This workshop has encouraged me to try"; and "It's worth the time. Excellent presentation by both presenters. Thanks!!!" The on-site observer reported, "The workshop served to break the barriers for some teachers about cooperative learning."

### Kick-Off Reception

On October 7, 1988, the collaborative sponsored a wine-and-cheese "Kick-Off" at the home of one of the teachers. Only 12 teachers attended the event. The low attendance was attributed to the heavy demands that are placed on teachers so early in the school year as well as the activity being scheduled on a Friday. It was also suggested that perhaps teachers are not interested in attending a collaborative event that is strictly social.

### Industry Applications and Tour

On May 10, from 4:30 to 6 p.m., the collaborative sponsored an industry applications tour of the Union Bank to acquaint teachers with applications of mathematics in the real world. Participants toured the bank's data center and listened to a discussion of mathematics requirements for employees. Attendance was to be limited to 25 teachers, but only ten participated; the limited attendance was attributed to the fact that teachers place a higher priority on activities directly related to the classroom and the potential difficulty of parking downtown.

In general, the teachers enjoyed the tour. One teacher commented, "It was exciting to see the inside operation of a bank. I was impressed." Another teacher said, "There wasn't as much demonstration of applications as I wanted. I wanted to see how math is used in the bank. There was little of that. I enjoyed it overall, however."

### Collaborative Retreat

The third annual retreat for the teachers and staff of the San Diego Urban Mathematics Collaborative was held March 10-12, at the Lake Arrowhead Conference Center. The retreat focused on the issue of permanence and on the future goals of the collaborative. The goals of the retreat, as outlined by the Planning Committee, were to provide collegiality and opportunities for professional development; to create an environment that would foster a power base within the mathematical community for effecting change; to develop leadership skills; and to promote equity and professionalism.

Twenty-three people, including 16 collaborative teachers, the collaborative's two directors and two coordinators, the on-site observer, Brian Lord from the UMC Outreach Project, and Norman Webb from the UMC Documentation Project, participated in the weekend. All expenses were paid by the collaborative. Attendance was less than what had been projected and represented a significant decrease from last year's one-day retreat. Prior commitments and family obligations were cited as reasons by teachers who could not attend.

Registration began at 3:30 on Friday afternoon and continued until dinner, which was served at 6:30. After dinner, Ms. Marosz welcomed participants, who became acquainted through a matching activity.

Although permanence and equity were the focus of the weekend, time was also allocated for networking and socializing. Topics discussed included UMC's goals and objectives, the collaborative's organizational structure, assessing and meeting the needs of teachers, deciding whether to become a political force in the state, and equity issues.

Teachers' reactions to the retreat were very positive. Comments included: "Very good activity"; "Really interesting . . . I had never met most of these people before"; "Exciting. For the first time I understood why equity is important"; "I'm glad I attended. It was worth spending my weekend here"; and, "Now I feel that the teachers are beginning to have a voice in what happens to them."

The on-site observer reported that these comments seemed to reflect a general consensus among participants that the retreat was a worthwhile experience. In commenting on the value of the retreat, she said, "This activity served to clear the air and impress upon the participants that the collaborative is at a crossroad . . . ."

## Grants and Scholarships

The collaborative kept teachers informed about the wide variety of grants and scholarship programs available during 1988-89.

### GTE Grant Program

The GTE grant program, Growth Initiatives for Teachers (GIFT), provides mathematics and science teachers of grades 7-12 in eight states with opportunities for school enrichment and professional development. Teams composed of one mathematics and one science teacher from a single school submit one School Enrichment and two Professional Development proposals. The School Enrichment proposal, prepared jointly, describes the design and implementation of a project that integrates science and mathematics in an innovative way. School Enrichment grants may total up to $7,000, and activities must take place during the 1989-90 school year. The Professional Development proposal, prepared individually by each team member, addresses a need for professional growth and implementation of the project. The Professional Development portion of the grant is $5,000, or $2,500 for each team member. Professional Development activities are to take place during the summers of 1989 and

1990. GTE will host all grant recipients from the eight states at a week-long seminar in late June, 1989. The collaborative has encouraged SDUMC teachers to apply.

### The California Mathematics Council Southern Section Grant Program

The California Mathematics Council Southern Section offers grants ranging from $100 to $1,000. Credentialed members of CMCSS are eligible to apply for the professional in-service grants and for professional scholarships to support continuing education and retraining. Information regarding the CMC scholarships has been included in several SDUMC mailings, as the scholarships are applicable to many of the summer programs that are offered throughout the United States.

### Other Grants

The collaborative also disseminated information about an equipment grant from Apple, scholarships from the TANDY Corporation, and grants awarded through Project TIME. Project TIME grants, funded by NSF and the State of California, allow teachers to attend a University of California-Santa Barbara conference on staff development, curriculum, and leadership issues in mathematics and science education.

## Regional and National Conferences and Workshops

At the beginning of each semester, the collaborative distributed Conference Preference Forms to teachers, asking them to indicate the conferences for which they would like to receive financial support from the collaborative. Based on teachers' responses, the Executive Committee identified recipients of collaborative funding.

### Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

The collaborative sponsored three teachers to attend the fifth annual Conference on Secondary School Mathematics and Computers at Phillips Exeter Academy in New Hampshire. SDUMC covered the costs of airfare, registration, housing and meals. The conference, which ran from June 26-30, 1989, focused on the impact and applications of computers in the mathematics curriculum of today and tomorrow.

Interested teachers were required to submit an application outlining how knowledge from the conference would help with their teaching, how attendance would help their departments meet their goals, and what the teacher hoped to gain personally from the experience. In addition, the teachers were asked to agree to conduct collaborative workshops upon their return.

One of the three teachers who attended the conference participated for the second consecutive summer. She reported that she thoroughly enjoyed the experience and especially appreciated the opportunity to work with Richard Houde on the Geometric Supposer.

## Annual Conference of the Southern Section of the California Mathematics Council

The collaborative offered stipends to cover the registration fees and accommodation costs of 15 SDUMC members, including 11 teachers, who attended a conference sponsored by the Southern Section of the California Mathematics Council (CMC) in Long Beach, California. The conference, held November 18-19, 1989, focused on the theme, "A Framework for Understanding." Six separate topics, each based on the California Mathematics Framework, were covered. Participants chose from more than 200 sessions and workshops, each related to one of the six major topics.

The teachers who were interviewed after the conference felt that the event was very beneficial and the on-site observer reported that the teachers seemed to gain more from the conference this year than in 1987-88. "The participants received more from this conference because they attended workshops rather than all general sessions," she noted. "The level of satisfaction seemed to be greater this year because of better logistics: early registration, etc." One teacher commented, "I liked it a lot. The math conference was fine. I was more familiar with the math. The math conference was like a regional conference." Another added, "I enjoyed it. This time I sent in the registration early and got to go to the workshops and they were excellent." A third teacher said, "I really enjoyed it! I haven't been to a math conference in years." Another teacher commented, "At least three workshops were really useful. I'm a new teacher. I go to new ideas which are working well. One was how to make the class come alive . . . ."

## NCTM Regional Conference in Boston

The collaborative sponsored one teacher to attend the NCTM Regional Conference held December 1-3, 1988, at John Brown University in Boston.

## Greater San Diego Mathematics Council Annual Mathematics Conference

The annual conference of the Greater San Diego Mathematics Council was held February 3-4, 1989, at the Convention and Performing Arts Center in San Diego. Keynote speakers included Father Bezuszka of Boston College Mathematics Institute, Chestnut Hill, Massachusetts; textbook author and mathematics education lecturer Lola May from the Winnetka, Illinois, public schools; and Patrice Davidson of the University of Massachusetts. The conference offered a variety of sessions including a series of workshops focusing on "Math Their Way."

All of the teachers at Bell Junior High, as well as several other collaborative teachers, attended the conference. The staff at Bell scheduled Friday as a "minimum day," allowing them to be at the conference. It was difficult for many of the other teachers to be released on Friday as the conference occurred during finals, and semester grades were due the following Monday. The collaborative paid the registration fee for the collaborative teachers who attended the conference. The collaborative also encouraged teachers to serve on GSDMC conference committees and to work as volunteers during the conference.

## Annual Meeting of the National Council of Teachers of Mathematics

The collaborative and the two school districts sponsored the attendance of 13 teachers and a project coordinator at the annual meeting of the National Council of Teachers of Mathematics (NCTM) in Orlando, Florida, April 12-15, 1989. Nine teachers from the SDUSD received travel and hotel expenses from their school districts, and the collaborative paid the registration fees. Four teachers from the SUHSD, one from each collaborative school, received half of their total expenses, including registration, from the school district; the collaborative paid the remaining half. In addition, two teachers attended at their own expense. The collaborative director also attended. Both school districts provided release time to allow teachers to attend the conference. In order to apply for collaborative funding, teachers submitted a one-page conference preference form in which they identified a topic on which they planned to concentrate at the conference; provided a rationale for the topic selection, taking into consideration their school's and their department's needs in mathematics instruction; provided a plan for disseminating their new knowledge and experience to colleagues; and outlined what they hoped to gain personally from the experience.

The conference theme was "Vision for the World of School Mathematics." Throughout the day, participants attended sessions on such topics as estimation, graphing techniques, math anxiety, brain function research, and computerized mathematics. In the evening, the teachers attended sessions with members of the other ten collaboratives from across the country. The evening sessions, sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and the Australian Mathematics Curriculum and Teaching Program. On Wednesday morning, members of the SDUMC Planning Committee met with UMC Technical Assistance Project Director Mark Driscoll to discuss issues related to permanence.

The teachers who attended the conference felt it was extremely valuable. They reported that the conference was well-organized, and filled with practical ideas and information that could be brought back directly to their classrooms and students. They also appreciated the opportunity to share ideas with teachers from other parts of the country. In a thank you note to Project Director Alma Marosz, one teacher wrote, ". . . I enjoyed the opportunity to contact other teachers throughout the United States and have made plans to exchange materials with teachers from Minnesota and Virginia. A real highlight of the trip was the opportunity to visit the NASA Space Center. I brought back many items of information for my students that can help the Space Program come 'alive' for them and help them to know that they, too, can become a part of this national endeavor . . . . In all, the conference was a rejuvenating, exhilarating experience!"

### Communication

During the 1988-89 school year, the collaborative distributed a monthly mailing to all collaborative members to keep them better informed about collaborative actions and events. The UMC mailing included minutes of the Executive Committee Meeting and announcements of UMC activities, as well as other information that might be of interest to UMC members.

To improve communication within the larger mathematics community, the collaborative published a column in the Exponent, the semi-annual publication of the Greater San Diego Mathematics Council (GSDMC). The collaborative staff also provided the UMC mailing list to GSDMC to ensure that all UMC members receive the Exponent, and encouraged teachers to submit articles about their UMC activities to the publication.

## E. Observations

### Project Management

The 1988-89 school year was a period of transition for the collaborative management. Efforts that once had focused primarily on staff administration shifted gradually to enhancing teacher leadership and empowerment. Several forces motivated this change. One was the increased assertiveness of teachers on the Executive Committee, who were determined to become more involved in collaborative decision-making. Teachers began to pose questions during the meetings and to express an interest in the administration and distribution of collaborative funds. Combined with this change was the co-directors' and co-coordinators' commitment to an administrative structure centered around teacher control. The transition was initiated with the formation of a teacher-dominated committee to plan the March retreat and to serve as the Planning Committee. As a result of the efforts of the Planning Committee and the planning that occurred at the retreat, three teacher committees were established late in the school year. In May, control of the Executive Committee was transferred to elected teacher officers. In previous years, Executive Committee meetings were chaired by Ms. Marosz; by the end of the 1988-89 school year, the meetings were conducted by teachers.

The collaborative continued to be administrated by its co-directors and co-coordinators. Although the original intent of the co-directorships was to transfer authority from Ms. Marosz to Dr. Koehler, the relationship between them was characterized more by a sharing of leadership than by a gradual assumption of responsibilities by Dr. Koehler. One complicating factor was that as teachers became more involved in operating the Executive Committee, the project director's role during the meetings changed. This new role, which emerged just as Dr. Arthur Ellis was brought on board to facilitate the process of increasing community involvement, demanded an experienced perspective on the part of the collaborative director; thus, circumstances foreclosed the possibility that responsibilities would be readily or easily transferred to Dr. Koehler. A definite time line for the transfer of responsibilities had not been established, so these new developments did not result in plans having to be altered. Dr. Koehler worked effectively with Ms. Childs-Moore in planning some activities. In developing the permanence proposal, it is possible that the collaborative may reconsider the viability of the co-directorships.

The division of responsibilities between the two co-coordinators has evolved in response to time constraints and the particular contributions that each individual is able to make, rather than on a well-defined strategy. Ms. Childs-Moore, having worked in the Sweetwater Unified High School District, provided an effective link to that district and a knowledge of its administrative operations. Similarly, Dr. Holmes brought experience with administrators in the San Diego Unified School District and the community to his role in the collaborative. Dr. Holmes' participation has been reduced this year because of his other responsibilities, which included directing a project for elementary students. In light of this, Dr. Holmes' appointment was reduced from one-fourth to one-eighth time in order to fund the co-director.

When Ms. Childs-Moore resigned in March, a very short period of time elapsed in which her position remained unfilled. Within a few weeks, however, Ms. Marosz hired Dr. Wyman to fill the vacated coordinator position. Dr. Wyman brings teaching experience and academic credentials to the position, but she did not have experience with either of the school districts. As a result, the strategy of dividing the co-coordinators' responsibilities in terms of the two districts needed reconsideration. At the end of the 1988-89 school year, Dr. Wyman was performing the administrative functions of the position.

While the two coordinators continued to meet with individual departments during the year, the frequency of such interactions was reduced from previous years. When asked to attend department meetings, both coordinators exhibited a willingness to do so. At the beginning of the year, Dr. Holmes and Ms. Childs-Moore attended department meetings together. As the year progressed, Dr. Holmes focused on the target schools in meetings together. As the year progressed, Dr. Holmes focused on the target schools in SDUSD while Ms. Childs-Moore focused more on the target schools in SUHSD.

The collaborative's group of targeted schools did not expand during the year to include the junior high schools that feed the three newer target high schools. As a result, the collaborative's teacher population remained at approximately 150 teachers. The core group of collaborative teachers includes about 30 teachers -- those who serve on the Executive Committee and teachers who participate in summer activities. Communication between the collaborative and teachers occurs through the Executive Committee representative from each target school. In addition, the minutes of meetings and other announcements are sent monthly to each teacher's home address.

Several important factors may affect management of the collaborative in the future. One factor is the plan for permanence, which will define the extent to which teachers assume and retain control of the collaborative. Changes in the school districts, such as Sweetwater High School's decision to become a year-around school and the district's initiation of a policy to restrict teacher release time, even though it was ultimately dropped, are other factors. In addition, schools in the San Diego Unified School District are being given more local control. Taken together, the changes in the districts and in the collaborative at the close of the 1988-89 school year suggest that the collaborative may function differently in the coming year.

### Collaboration

Some of the mathematics departments that have been energized through the efforts of the collaborative have maintained the momentum and now meet periodically as a group. The mathematics department at Morse, for example, meets over lunch. The mathematics department at Granger originally met one early morning each month, but then started to meet over lunch after the morning meetings had lapsed. Sweetwater High School did not have a specific time set aside for meetings. When asked about the effects of the collaborative, one teacher reported, "Our math department is much more of a group. We hardly knew each other before. [The collaborative] has given us a chance to get together." The collaborative has also fostered interaction among teachers from different schools through the monthly Executive Committee meetings, workshops, the retreat, and conferences. The interaction has been greatest among the 30 teachers who form the core group.

The March weekend retreat was a major collaborative effort to provide an opportunity for teachers from the target schools to become better acquainted and to work together to plan for the collaborative. Eight of the nine target schools were represented. Although participation was less than anticipated, the 15 teachers who attended did meet the goals of the retreat, and did become better acquainted. Some teachers had expressed an interest in the retreat, but had previous engagements or family commitments that prevented them from attending; other teachers might not have attended because a stipend was not offered. If the retreat is to be a regular feature of the collaborative, strategies should be developed to encourage a wider base of teachers who will participate.

During the year, the collaborative made a concerted effort to establish connections with other mathematics education programs in the area. In particular, the collaborative worked to strengthen its ties to the Greater San Diego Mathematics Council, an effort strongly supported by Dr. Vance Mills, the mathematics supervisor for SDUSD. Collaborative teachers are members of GSDMC and the collaborative publishes a column in the Exponent, the GSCMC newsletter. As a result of the strengthening relationship between the collaborative and the Greater San Diego Mathematics Council, a member of the collaborative now sits on the GSDMC Board. Collaborative teachers also have been very active in university summer programs, such as the California Mathematics Project directed by Professor Branca at SDSU and the teacher institutes at the University of California-San Diego. Three collaborative teachers served as lead teachers for the UCSD program during the summer of 1988.

Interaction between teachers and those in higher education, however, continues to occur primarily through mathematics educators at SDSU. As noted above, some teachers worked on a summer project at UCSD (although this was not arranged through the collaborative). During 1988-89, representatives of higher education were involved primarily through the Executive Committee. Although members of the SDSU faculty had presented collaborative workshops in previous years, most workshops during 1988-89 were presented by teachers. Although this is a positive trend in that it suggests that teachers are assuming a more prominent role, it inheres a reduction in the involvement of SDSU faculty. The members of the mathematics education faculty at SDSU are very active professionally and are engaged in a variety of projects at the local, state, and national levels. As a result, teachers have the potential to interact with the SDSU faculty in many ways. It is possible that other representatives from higher education in the area, including those who participate in the teacher institutes at UCSD and other faculty in mathematics at both UCSD and SDSU, could contribute to the collaborative in a more formal way. Both UCSD and SDSU are trying to establish a joint doctoral program in mathematics and science education. It seems likely that joint efforts through the collaborative could benefit collaborative teachers and also further the interests of both institutions.

Until the breakfast meeting in June, collaboration with the business and corporate sector remained essentially unchanged from previous years. Ms. Marosz assumed the major responsibility during the year for establishing links between the collaborative and business. One outcome was the May site visit to the Union Bank in which ten teachers participated, far fewer than the 25 maximum. The low attendance raises the questions of whether teachers find these visits to be of value and whether the time of the visits is convenient. One difference from site visits conducted by other collaboratives is that teachers in other sites have been involved in arranging for the visits by going to the business and helping to assure that the presentation is relevant to teachers' interest. In this case, the director of the collaborative served this function.

Other developments during the 1988-89 school year were encouraging and have the potential of linking the collaborative with the corporate sector. One such development has been the increased activity of the San Diego Compact. The Compact sponsored a December conference on dropouts and co-sponsored a meeting on partnerships. Ms. Marosz and Ms. Childs-Moore attended the partnership conference, which featured speakers from successful programs that involved cooperation of business, teachers and other educators. Although many of the schools in the San Diego area have business partners, the effectiveness of these partnerships varies from school to school. Clearly, the collaborative is not the only organization in the area concerned with linking teachers and business. The questions confronting the collaborative are how to tap into existing resources and networks, and how to develop ongoing relationships with businesses independent of other efforts.

Professor Arthur Ellis' efforts to help develop stronger links between the collaborative and the community were a key element in the process. The June breakfast meeting was very successful, in that a number of people representing a variety of groups attended and became interested in what the collaborative was doing. This breakfast spawned the creation of the Community Steering Committee, which may provide a critical link between the collaborative and other community groups, including businesses and the Navy. The board of directors for the San Diego Mathematics

Science Enrichment Project directed by Dr. Holmes is proof that this type of community-based group can be successful.

At this stage in its development, the collaborative is addressing key questions about its agenda, its structure, and its relationships with other agencies and organizations. A core of about 30 teachers form the central group upon which the project can build. Today, the challenge is for these teachers and the collaborative staff to expand to encompass other teachers in the target schools and to engage in a significant way representatives from business, higher education, and the community at large. Only with a broad-based foundation of support can the collaborative move toward permanence.

### Professionalism

Collaborative teachers attended more conferences during 1988-89 than they have in the past, and they are working more closely and effectively with their department colleagues. During the school year, the teachers assumed a stronger leadership role in both decision-making and in conducting workshops. Teachers on the Executive Committee discuss important collaborative issues and have served as strong links between the collaborative and teachers in their respective schools. It should be noted that the communication flows both ways: members of the committee disseminate information to the teachers at their schools, and conduct discussions with teachers in order to gain their input to bring back to the Executive Committee meetings.

Teachers, however, are encountering barriers as they assume more responsibility. One department head, for example, applied for and received funds from the California Mathematics Project to develop a space in the school for a department office. After the department office was in operation, however, the space was reallocated for record storage because the storage area was needed as office space for three new vice principals. It appears that although collaborative teachers are taking more action and have begun to challenge the system, they have not reached the point of being empowered to overcome strong obstacles or administrative agendas. Asked about significant changes because of the collaborative, one teacher commented, "[The] department is working together, is more focused, and talks specifically about goals. Teachers now feel that they can challenge the principal about things that he wants to do. It's a matter of degree. We haven't gotten there yet, but now there are more people working together."

The March retreat appears to have fostered a professional spirit among teacher participants. At the retreat, presentations focused on three critical issues and teachers divided into small groups to discuss each topic in detail. One issue addressed the permanence of the collaborative and the organizational structure the collaborative should assume. A second issue was professionalism. Examples of questions discussed included: What is professionalism? What makes teaching a profession? How can teachers be strengthened? The third issue was equity. After presentations by Ms. Marosz, Dr. Holmes, and Ms. Gosselin, in which statistics identifying a problem were presented along with an example of a program that addresses the problem, the teachers broke into small groups to develop ideas about what the collaborative could do to address the issue.

Each of the topics were of crucial importance to the teaching profession. An important element or aspect of professionalism is access to a common reference group in which there is an exchange of ideas. The retreat provided the opportunity for such discussion, although time was insufficient to reach a common understanding or consensus on any of the issues. Each topic was broad and complex enough to have been the focus of an entire retreat. Teachers brought a variety of perspectives to the March retreat, and some had difficulty understanding the issues and their causes. After the equity discussion, in trying to align others' comments with his own experiences, one seventh grade teacher questioned, "Why is it that if the blacks and Hispanics are performing so poorly, there is such a discipline problem?" This teacher was struggling to understand what he had heard during the session while he grappled with personal issues based on experiences in his own classroom. The retreat did generate discussion and help teachers become better acquainted; it was not intended to reach resolution on the issues. Still, it became apparent that consensus on goals may require that teachers have ample opportunity for personal interaction so that they can come to understand a variety of perspectives on any given issue.

## Mathematics Focus

The mathematics focus of the SDUMC continues to be derived from the California Framework. The collaborative-sponsored workshops on graphing calculators, cooperative learning, and the Geometric Supposer correspond to emphases in the Framework and in the NCTM Curriculum and Evaluation Standards. During the 1988-89 school year, collaborative programs emphasized providing experiences for high school teachers, as compared to previous years when workshops were targeted primarily at junior high school teachers.

According to teachers and staff, the collaborative has changed what teachers know and how they perceive mathematics. The director observed that collaborative teachers talk more about the Standards than do teachers who are not participating in the collaborative. When asked about the impact of the collaborative, teachers report a range of changes. One teacher said, "It has made us think more about goals in math." Another teacher reported being more attentive to different groups of students: "There is more of an effort to be more rigorous than before. We have a weak student population, but we are now finding different ways to work with them." A third teacher has changed her approach to teaching: "I stress more working in small groups. They're getting used to working in pairs. Some kids who never would have participated are now participating."

Both districts are moving toward a core curriculum concept and eliminating general mathematics, a change that is occurring during a time of leadership fluctuations. Sweetwater Unified High School District, for example, does not have a mathematics coordinator. Furthermore, in at least some mathematics departments, differences of opinion have emerged between teachers with mathematics backgrounds and those without. When a collaborative teacher was asked about recommendations for improving the mathematics curriculum, the teacher responded, "Our department is in a real battle over that issue...50/50 split...the mathematics major vs. the non-mathematics majors. Math people want kids to stay in algebra until they learn the concepts before moving on. Non-mathematics people want everyone to be exposed to concepts." While there is general consensus that curricular development and change are valuable, there is conflict about the direction that change should take.

The collaborative has clearly affected mathematics teachers and their professional practices. Enabling teachers to attend conferences, both in-state and nationally, has exposed them to new ideas and approaches. The workshops, many led by collaborative teachers, offer new concepts and opportunities for collegiality. Teachers report increased use of cooperative learning groups and manipulatives to provide a transition from concrete materials to abstract ideas. The collaborative also has supported teachers and fostered in them the courage to affect change. In response to a question on the most significant changes that can be attributed to the collaborative, one teacher commented, "My attitude. It is an important one. The fact that you realize that someone does care. The collaborative is trying to point out that you are important." Another teacher commented, "We used to be isolated and no one knew what anyone else was doing. Now we openly share and are aware of what is going on with each other."

### F. Next Steps

The San Diego Urban Mathematics Collaborative will continue to develop its permanence proposal during the first semester of the 1989-90 school year. As a part of this process, a Community Steering Committee has been established and met during the summer to develop ways of increasing the collaborative involvement of the larger San Diego community. A Governance Committee also was formed and met during the summer to create a governing structure for the collaborative. As a result, the name of the Executive Council was changed to the Council of Math Education and a Board of Directors was formed. Andy Ashcraft, a San Diego mathematics teacher, will chair the Council, which will meet monthly during the school year. The Council will be aided by an activity committee and a bylaws committee.

The collaborative will continue to sponsor activities and to support teachers' attendance at a variety of events. In August, 1989, the EDC will sponsor two collaborative teachers' attendance at the UMC Leadership Conference in Newton, Massachusetts. One teacher from each school district will be selected to attend. A Friday afternoon fall retreat is planned for October. Retreat topics will include geometric probability, problem-solving strategies using Logo, and robotics. A workshop on contemporary applied mathematics is planned for November, to be presented by Dr. William Sacco, an applied mathematician and owner of Tri-Analytics. As in previous years, the collaborative will offer to pay expenses for at least two teachers from each collaborative school to attend the Annual Meeting of the California Mathematics Council in Long Beach in November. The collaborative will also develop a procedure for selecting teachers to receive collaborative support to attend the NCTM Annual meeting in Salt Lake, Utah, in April, 1990. In addition, the collaborative will continue to inform teachers of workshops and other professional opportunities.

# SUMMARY REPORT:
# SAN FRANCISCO MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation Project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the San Francisco Mathematics Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the San Francisco Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; a report to the Ford Foundation on collaborative activities for the period April-December, 1988; documents provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held in Orlando during the annual NCTM Conference in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

## San Francisco Mathematics Collaborative

### A. Purpose

The vision and goals of the San Francisco Mathematics Collaborative were reformulated over a four-month period, during which input was sought from teachers, district administrators, and community representatives. Throughout the process, careful consideration was given to the goals for mathematics education that have been articulated by the San Francisco Unified School District. At the summation of this process, it was the consensus of participants that the collaborative's primary goal is the development of a network of teachers who are motivated, knowledgeable, and accountable to their colleagues and students, and who have opportunities to become the best mathematics educators possible. In achieving this goal, the basic functions of the San Francisco Mathematics Collaborative are defined as:

1. To create points of intersection for meaningful dialogue among K-12 teachers, representatives of higher education and local science museums, district administrators, the business community and other organizations that would benefit from an improved education system in San Francisco.

2. To provide a "safehouse" where teachers can freely express their needs and concerns, share their creativity in open-ended exploratory activities, engage in reflection-oriented activities, take risks and initiate activities.

3. To provide teachers with opportunities for professional development and collegiality based upon mathematics education.

4. To provide a structure in which teachers can take the lead in the improvement of mathematics teaching and learning.

5. To provide a vehicle through which the community can invest in excellent mathematics education and support teacher ideas that advance quality mathematics education in San Francisco schools.

6. To provide opportunities for teachers to discuss issues of equity as they relate to mathematics education for underrepresented minorities and girls, and to link the activities of the mathematics collaborative to equity issues.

## B. Context

Approximately 700,000 residents live within the city limits of San Francisco, which encompasses all of San Francisco County. The San Francisco Unified School District (SFUSD), which in 1988-89 served approximately 63,000 students, is comprised of 110 schools; 16 are middle schools (grades 6-8), 8 are comprehensive high schools with populations ranging between 1,800 and 2,651 students (grades 9-12), and 14 are smaller alternative schools or specialized schools (9-12).

Of the district's total student population for 1988-89, approximately 48 percent are female and 52 percent are male. Eighty-five percent are minority students, as compared with a national average of 49 percent: 34 percent are Asian, 19 percent are black, 19 percent are Hispanic, 15 percent are white, 1 percent are American Indian and 12 percent are of other ethnic origin. Thirty-four percent of the student population considers English a second language; 29 percent of the total number of students are Limited English Proficiency (LEP) students. Eighteen percent of students in the district come from families that receive AFDC support, and 92 percent are eligible for federally funded lunch programs.

Total enrollment in the district (K-12) has declined over the past 20 years, from a high of 94,000 students in 1968 to a low of 57,000 students in 1982. Since 1985, enrollment has remained fairly constant at approximately 63,000 students.

Approximately 20,500 students were enrolled in the district's high schools during 1988-89. Forty-eight percent of the high school population was female, while 52 percent was male. Forty-one percent of students were Asian, 17 percent were black, 14 percent were white, 17 percent were Hispanic and 11 percent were from other ethnic groups. Thirty-three percent of the high school population considered English a second language. Approximately 18 percent of high school students' families receive AFDC support, and 92 percent are eligible for federally funded lunch programs.

Of the approximately 12,000 high school students enrolled in mathematics in the 1987-88 school year, 54 percent were Asian, 14 percent were white, 11 percent were Hispanic, 9 percent were black and approximately 13 percent were of other ethnic origins.

High school students in the SFUSD performed above the national average in mathematics on the Comprehensive Test of Basic Skills (CTBS), with a mean score in the 61-74 percentile range for grades 9 and 10, and in the 75-88 percentile range for grade 11. Reading scores, however, were within the 26-39 percentile range for grades 9 and 10, and in the 40-60 percentile range for grade 11. The district instituted a new minimum skills test in 1987-88 to assess the competency of graduating seniors. Satisfactory performance on the test is a requirement for graduation. The new test, which is a portion of the CTBS, replaces one that had been created by district mathematics teachers. The new test is significantly different in that it includes a greater emphasis on comprehension questions and less on basic skills.

Three of the district's secondary schools are designated as academic high schools. Lowell High School, with an enrollment of 2,651, accepts only students who have maintained close to a straight-A average during the second semester of seventh grade and the first semester of eighth grade, and test scores above the 97th percentile on the CTBS. Sala and Phillip Burton High School and Wallenberg High School have smaller, open enrollments, with students selected by lottery. Students enrolled at these high schools take college preparatory classes and are required to have four years of mathematics. At Sala and Phillip Burton, students who receive a grade of D or lower must repeat the course.

The SFUSD employed approximately 1,000 high school teachers during 1988-89. Of these, 45 percent were female and 55 percent were male. Sixty-four percent were white, 14 percent were Asian, 10 percent were black, 8 percent were Hispanic, 1 percent were American Indian and 3 percent were from other ethnic groups. There are approximately 190 mathematics teachers in the high schools, about 100 of whom hold a bachelor's degree with a mathematics major or minor. Data on the gender and ethnicity of mathematics teachers were unavailable.

High school teachers' annual salaries averaged $39,477 for the 1988-89 school year. Statewide, teachers in California earn an average salary of $33,000, making them the fifth highest paid teachers in the nation. It should be noted, however, that California has the second highest cost of living and the largest average class size in the nation. Approximately 25 percent of high school teachers and approximately one-third of all teachers in San Francisco are members of an active teachers' union: the San Francisco Classroom Teachers Association (SFCTA), an affiliate of the California Teachers Association. Another one-third of San Francisco are members of the American Federation of Teachers (AFT).

As a result of their dissatisfaction with a number of issues, San Francisco teachers voted to switch from the SFCTA to the AFT to represent them in contract negotiations in 1989-90. About a third of the teachers in the district belong to each union, with the remaining teachers not holding a union membership. The most often stated reasons for the change included teachers dissatisfaction with class-size, lack of progress towards merger of the two unions, lack of action to stop the district from hiring new teachers as long-term substitutes, and the desire for teachers to be more actively involved in on-site decision making.

District Superintendent Ramon Cortines, who has been in office for three years, faces a $10 million budget cut as well as a need for approximately $450 million to repair and refurbish schools and facilities. Moreover, cost of asbestos cleanup in SFUSD schools was estimated at $15 million in 1988. Budget cuts over the last two years are taking their toll on the district. Students have been forced to share desks, many elective classes have been eliminated, middle schools have cut sports programs, and materials have been in short supply. In 1987, class sizes were increased and approximately 460 employees were laid off. In March of 1988, Superintendent Cortines recommended that 144 teachers and 54 administrators be laid off to save the district from bankruptcy, a proposal that was subsequently rejected by the School Board. In 1988-89, a hiring freeze was placed on the district so that no additional teachers could be hired. In the face of such difficult decisions, Superintendent Cortines was praised by the San Francisco Board of Education for his strong leadership, his efforts to improve curriculum, and his policy of holding principals, teachers and staff accountable for improving the quality of education in their schools.

In the summer of 1988, the state legislature voted to transfer $550 million in windfall tax revenues to K-12 classes statewide; the distribution of funds occurred during the 1988-89 school year. In addition, taxpayers approved a $90 million bond issue to generate revenues for state schools; as of yet, it is unclear to what extent this money will affect San Francisco schools. In 1987-88, approximately 76 percent of the district's total revenues originated from California state funds, 15 percent from local monies, 8 percent from federal sources, and about 1 percent from county and other outside sources.

Policy Analysis for California Education, an educational policy research center, has predicted that 142,000 new children will enter California schools each year between 1987 and 1997, requiring about 80,000 additional teachers and 1,500 new schools over the course of the decade. Given the limited growth possibilities in San Francisco county, it is unclear whether these increases will affect SFUSD schools through overcrowding, busing to outside systems, or the construction of new schools.

The Mathematics Curriculum Team Leader for the SFUSD is Ms. Maria Santos. Her responsibilities include supervising the district's K-12 mathematics program. Prior to her appointment at the beginning of the 1987-88 school year, Ms. Santos worked with the K-8 mathematics/bilingual program and was a junior high school mathematics resource teacher and a high school mathematics teacher. In February, 1989, Bernard Farges, a mathematics teacher from Mission High School, was appointed as a second Mathematics Curriculum Team Leader. He is assuming responsibility for SFUSD's participation in Project 2061, a mathematics and science education project sponsored by the American Association for the Advancement of Science (AAAS).

One of the district-wide goals defined by Superintendent Cortines is the identification of a common curriculum in all high schools. The district, therefore, adopted a single textbook for all SFUSD Algebra I classes, beginning in the 1987-88 school year. During April and May, 1988, a Geometry Curriculum Development and Textbook Selection Committee met five times to select the geometry textbook to be used in the 1988-89 school year. Two texts for regular geometry and a combination of books for honors geometry were adopted.

After spending $70 million over a five-year period, desegregation of the SFUSD remains an issue. Because of a mandate that limits the proportion of any ethnic group in a school to 45 percent of the student population, many black students are unable to attend improved schools in their own neighborhoods. Minority test scores remain low and dropout rates have not declined significantly. Three collaborative teachers, along with professors at UC Berkeley and the San Francisco Education Fund, obtained NSF funding for a project designed to improve the mathematical skills of minority students and to develop model mathematical curricula. The project, STAMP (Students and

Teachers Acquiring Mathematical Power), was initiated in the summer of 1989. The project incorporates site-based staff development and teacher-developed curricula. It includes a transition summer school program and a continuation into the academic year.

The San Francisco Math Teachers Association (SFMTA) elected new officers in May, 1989. Sandy Siegel is the new president, which marks the first time a middle school teacher has held this position. Leaders from the SFMTA met with leaders from the San Francisco Mathematics Teachers of Elementary and Middle Schools (T.E.A.M.), an organization of elementary school mathematics teachers, and agreed to work closely in planning activities for the 1989-90 school year. This cooperation was encouraged by the collaborative, especially in light of the project's intention to expand to include elementary teachers. Representatives of the SFMTA meet monthly with collaborative representatives, district Core Curriculum leaders, and representatives of the SFUSD in pre-school "earlybird" sessions (7 a.m.) to discuss the relationship among the organizations and the improvement of mathematics education in the area.

The state of California has mandated that, as of September, 1988, all teachers must be certified in the content area in which they teach. This new requirement will have a particularly severe impact on mathematics instruction in the district given that many of the teachers now in mathematics classrooms--especially general mathematics and Algebra I--do not have a major or minor in mathematics. It is estimated that more than one in four algebra classes are taught by teachers who have neither a mathematics major nor minor. Principals will be held responsible for ensuring that all teachers become certified by passing the National Teachers Examination (NTE). To help teachers receive certification, SFMTA, Dr. Marcucci, and the collaborative established a NTE preparation course during spring, 1989, with funding from the SFUSD.

Other opportunities for continuing education for mathematics teachers in the Bay area include colloquiums and the Industry Initiatives for Science and Mathematics Education (IISME) eight-week summer program sponsored by the Lawrence Hall of Science. The IISME and the Consortium are associated with the University of California at Berkeley. In addition, elementary teachers could participate in the Bay Area Math Project and the EQUALS Project.

## C. Development of the Collaborative

The San Francisco Mathematics Collaborative experienced major change in its administrative structure during the 1988-89 school year, especially as it addressed issues of permanence. Ms. Judith Massey Morales, Director of Programs and Evaluation, continued as manager of all of the collaboratives funded through the San Francisco Education Fund (FUND). In addition to the mathematics collaborative, Ms. Massey Morales oversees collaboratives in science, art, and the humanities. Ms. Gladys Thacher, Executive Director for the FUND, continued to serve as liaison between the collaborative, the Ford Foundation, SFUSD, the donor community, and the FUND Board of Directors.

Dr. Robert Marcucci, a mathematics education professor at San Francisco State University, continued to serve as the collaborative coordinator through December, 1988, at which time he returned to full-time teaching. As coordinator, Dr. Marcucci worked 72 hours a month for the collaborative while he continued to teach at San Francisco State University. Until Ms. Lise Dworkin's appointment as director on April 1, 1989, the collaborative was managed under the joint direction of Ms. Massey Morales and Ms. Santos, the mathematics curriculum team leader for the SFUSD. Ms. Dworkin holds a master's degree in mathematics education from the University of California at Berkeley, where she was a supervisor of teacher education and one of three to administer the K-12 credential program. She also served as the coordinator of public programs for the Consortium for Excellence in Mathematics Education at the University of California at Berkeley, and has taught elementary school for five years.

Ms. Dworkin was appointed after a two-month search that began in January, 1989. The duties specified on the position announcement for project director included directing the collaborative; maintaining communication among teachers, administrators, the SFUSD, the FUND, and all other partners; staffing all Collaborative Council meetings; designing and implementing projects; providing leadership; and assisting the FUND in generating financial support for the collaborative. The announcement was sent to all mathematics teachers and administrators in the district, to the other UMC collaboratives, and to college and university mathematics and education departments. In addition, an announcement was placed in the SFMTA newsletter. Applications were screened by Dr. Roger Tom, Director of Curriculum for the SFUSD, Ms. Maria Santos, and Ms. Massey Morales. A subcommittee, which included three teachers from the Collaborative Council, interviewed the ten top candidates. Mr. Thacher and Dr. Linda

Davis, the SFUSD Deputy Superintendent of Instruction, made the final decision, after considering the recommendations of the subcommittee.

Ms. Janice Toohey filled the part-time position of Development Director for the collaborative through August, 1988. At that time, the position was merged with a similar position for other FUND collaboratives to create a full-time position in the Education Fund's Development Department. Since August, 1988, Program Developer Ms. Joanna Pineda has portioned her time equally among four collaborative projects to pursue fund raising. The mathematics and science collaboratives also share a full-time administrative assistant. Ms. Jill Jefferis held this position until June, 1989. Ms. Jefferis, who had office space at the Parkside Center, attended to administrative and financial clerical details for the collaborative and worked with the San Francisco Math Teachers Association to prepare the newsletter. Delano Spicer, a mathematics teacher at Sala and Phillip Burton High School, served as the on-site observer during the school year.

The FUND has also employed Mr. Paul Harder since 1987 to evaluate collaboration as it is supported by the FUND. His position is funded through the Walter S. Johnson Foundation grant that helps support the FUND's collaborative efforts. He also evaluates the FUND's school base grants.

The Steering Committee and the Teachers Council, the original governing structures of the collaborative, met two or three times in the fall prior to the restructuring of the collaborative that began in January, 1989. These meetings were used to coordinate on-going activities.

## Planning for Permanence

In May, 1988, the FUND submitted a proposal to the Ford Foundation to extend funding for the collaborative. The Ford Foundation responded that the proposal did not identify a vision for the collaborative sufficiently clear to guide it to a permanent state within the community, and in July, 1988, offered the FUND an extension until December, 1988, to allow time for the creation of a long-range vision and a plan for permanence. The collaborative was granted $17,000 as an advance from the $100,000 in final funding from the Ford Foundation, to support teacher activities between

September 1 and December 31. EDC engaged Dr. Phil Daro, Director of the California Mathematics Project, to be a facilitator for the permanence process.

On September 22, 1988, Ms. Massey-Morales met with the Steering Committee to discuss the Ford Foundation's requirements for a permanence plan. She stressed the need for a coherent vision for the collaborative and reported that the plan was to be completed by December 15, 1989. It was noted that Dr. Mark Driscoll, EDC, and Dr. Phil Daro were assisting her in the planning process and that they had met with SFUSD officials.

The nine members present at the meeting raised six important issues regarding permanence:

1. Should the collaborative include teachers in grades K-12?

2. Will the collaborative's current emphasis on high school mathematics teachers continue?

3. Can the collaborative obtain sufficient financial support from the Education Fund, school district, and other sources to support its vision?

4. Can the collaborative help the district by facilitating communication among teachers about issues in mathematics education?

5. How will the governance structure of the collaborative change to accommodate permanence?

6. Is the permanence of the collaborative a top priority of the Education Fund?

In addition, the Steering Committee noted that the Education Fund had submitted a grant proposal to the San Francisco Foundation to support both collaborative activities and the STAMP (Students and Teachers Acquiring Mathematical Power) project, and that program priorities should stem from the collaborative's vision.

Efforts exerted during the four-month planning period focused on developing a vision and a financial plan for permanence. A Program Vision Planning Group was formed and charged with responsibility for defining the vision, specifying the goals, and identifying the structure needed to meet those goals. This group consisted of past and present collaborative participants; potential participants (including elementary, middle, and high school teachers); members of various professional mathematics and teacher organizations; district administrators, FUND Board members, including some from business; college and university professors; representatives of scientific institutions; and FUND staff. The Program Vision Planning Group met five times over four months. Attendance at most meetings ranged from 20 to 25 people, although as many as 50 people attended some of the meetings. All of the meetings were facilitated by Dr. Daro. Dr. Mark Driscoll of EDC attended two of the meetings. Sometimes working in subgroups, the Program Vision Group developed a mission statement, a set of goals, and an organizational structure for the mathematics collaborative.

A financial plan was developed by SFUSD staff, the FUND, and the decision-making bodies of other interested organizations, with input from the Program Vision Planning Group and the FUND Finance Committee. At issue was whether the FUND should set the precedent of making a long-term commitment to financially support a program after foundation funding had ended. To further the process, Dr. Daro and several of the FUND Board members made a presentation to the FUND's Board and responded to their questions and concerns. At its December 12, 1988 meeting, the FUND Board voted unanimously to continue its participation in the mathematics collaborative by committing $110,000 over four years to its program activities, and continued support of staff positions. This, in addition to a $100,000 commitment from the San Francisco Unified School District and in-kind commitments from other partners, resulted in a total of $400,000 in funding for the collaborative over a period of four years.

Prior to the proposal's submission to the Ford Foundation on December 15, 1988, it was reviewed and critiqued by a 20-member Proposal Review Group composed of teachers, district administrators, college and university partners, and FUND Board members. In January, 1989, the proposal was approved by the Ford Foundation, and in June, 1989, the FUND submitted a report to the foundation describing the activities and expenditures for the period from April to December, 1988.

## Permanent Structure

In the process of developing its permanence proposal, the collaborative recognized the importance of an operating structure that addressed the needs of the SFUSD and the ongoing efforts by teachers to achieve greater control. With the acceptance of the proposal in January, 1989, the collaborative's focus was expanded to include the approximately 1,500 K-12 teachers who teach mathematics in the district. The SFUSD continues to support the time devoted to the collaborative by Mathematics Core Curriculum Team Leader K-12 Ms. Maria Santos. In addition, the district added another Mathematics Core Curriculum Team Leader K-12 in February, 1989, who will also work closely with teachers and the collaborative to build a strong K-12 mathematics education program in San Francisco. In April, 1989, a full-time collaborative director was hired to manage the collaborative's activities; to maintain communication among the various groups associated with the collaborative; to oversee collaborative-related meetings; to design and assist others in developing projects; to provide leadership; and to help with fundraising. The Mathematics Collaborative Council was established as the collaborative's primary decision-making body to give teachers control as they developed professional relationships with their colleagues and mathematicians from other sectors. To assure coordination between the FUND and the district, a coordinating group was established consisting of the district's mathematics core curriculum team leaders, the collaborative project director, and the FUND's director of program and evaluation. This group will meet as needed to ensure that collaborative activities are aligned with overall district and FUND goals.

## Mathematics Collaborative Council

The Council is composed of 29 members, 22 of whom have voting privileges. Members include 12 elected teachers (four each from elementary, middle and secondary schools); one representative from each of the teachers associations (San Francisco Mathematics T.E.A.M. and San Francisco Math Teachers Association); three representatives from the SFUSD (one with voting privileges); two representatives from the FUND (one with voting privileges); two representatives from the Exploratorium (one with voting privileges); four representatives from colleges and universities (two with voting privileges); and four representatives from the business community (three with voting privileges). Council membership can be expanded by a majority vote of the members; in order to maintain the teacher majority, additional teachers will be added as needed.

Teacher members of the Council were elected by the teachers in the district. In March, 1989, district teachers were asked to nominate teachers for the 12 Council seats. Seven high school teachers, six middle school teachers, and eight elementary teachers were nominated. Each nominee submitted a short statement of why he or she wanted to participate; these were included on the ballot. The appropriate grade-level ballot was sent to each mathematics teachers (K-12) in the district. The four teachers who received the most votes for each level were given seats on the Council. Other Council members were appointed based on their position or interest.

Council operations are planned by a Steering Committee comprised of Council members, including three teachers (one representative from each level) and one representative from each of the collaborative's three partners (one from the district, one from the FUND, and one other Council representative). The Steering Committee is responsible for scheduling Council meetings, setting the agenda, and assisting the collaborative director in implementing policy decisions. The work of the Council will be aided by three subcommittees. The Issues Subcommittee will focus on mathematics education issues in San Francisco. This group will identify issues by conducting an annual needs assessment, by reviewing research, by committee discussion, and by addressing the NCTM Curriculum and Evaluation Standards and the California Mathematics Framework. The Projects Subcommittee will oversee collaborative projects, recommend new projects and report on current projects. The Resources Subcommittee will coordinate efforts to acquire and retain the financial and human resources needed by the collaborative.

The Council met in April, May, and June, 1989. The majority of meeting time was devoted to planning and goal setting. Because the Council meetings provided the first formal opportunity for elementary and secondary teachers to meet together, some time was needed for them to begin to understand one another. One of the constraints was the two distinct professional mathematics teacher organizations, the SFMTA to which secondary teachers belong, and the San Francisco Mathematics T.E.A.M., to which elementary teachers belong. Topics of discussion included implementation of the NCTM Standards, activities that would bring K-12 teachers together, and equity.

The new Council met for the first time on April 17, from 4 to 6 p.m. at the Parkside Center. The agenda included a discussion of the roles and responsibilities of the Council; an update on the work of the transition team; a review of ongoing and planned collaborative activities; and a discussion of the current tasks of the Council, including establishing program plans, organizing Council committees and recruiting participants. Twenty members attended the Council's second meeting, held May 8--ten teachers, three representatives of higher education, two from SFUSD, two from the FUND, one from SFMTA, one from the San Francisco Mathematics T.E.A.M., and the collaborative director. Agenda topics included the budget, visitation days for cross-grade visits, and plans for 1989-90.

At its third meeting, held June 19, 1989, the Council discussed proposed activities and how they related to collaborative goals. As a result, Council members agreed that collaborative efforts should emphasize: involving as many teachers as possible, providing professional development opportunities for teachers with all levels of mathematical knowledge and abilities, and disseminating the NCTM Standards. Thirteen members, including six teachers, two representatives from higher education, one from the San Francisco Mathematics T.E.A.M., two from the FUND, the director, and one other member, attended the meeting. A tentative schedule of Council meetings was set for the fall, designating the meeting date as the second Thursday of each month, beginning in September, 1989.

The Issues Committee met from 4-6 p.m. on May 22, 1989, at the Parkside Center. The five members in attendance discussed their committee's relationship to the Program Committee and whether there should be two separate committees. They recommended that both committees meet on the same day so that they could meet jointly after they each met independently. In other action, they recommended that the collaborative disseminate a single-sheet monthly newsletter and discussed the possibility of developing a Resource Guide that would list teachers and other community representatives. Other topics of discussion included cross-grade visitations and equity.

The Program Committee met from 4-6 p.m. on May 24. The 11 committee members in attendance agreed that the two committees should schedule their meetings on the same day. Other topics included the cross-visitation program, equity, an opening activity for the fall, a K-12 conference for 1989-90, the Exploratorium's role for 1989-90, and workshops that could be provided by the City College.

## D. Project Activities

During the 1988-89 school year, the San Francisco Mathematics Collaborative sponsored a variety of activities that enabled teachers to establish networks with their peers and with other professionals, and increased their awareness of the developing world of mathematics and its applications. A number of activities sponsored by the San Francisco Math Teachers Association, by the San Francisco Unified School District or by other Bay Area institutions also provided significant opportunities to area mathematics teachers. The collaborative supported teachers' participation in these activities by publicizing the events and, in some cases, providing funds to allow teachers to participate.

### Exploratorium Summer Teacher Institute and Independent Study

Six collaborative teachers participated in the fourth Summer Teacher Learning Institute in Mathematics at the Exploratorium, June 27-July 27, 1988. Classes met five days a week, from 8:30 a.m. to 12:30 p.m. The collaborative paid each teacher a $1,000 stipend, and they were also eligible to receive upper-division science credit through San Francisco State University.

The 1988 Summer Institute focused on exploring mathematics through the exhibits of the Exploratorium. Some of the exhibits had been designed specifically for the purpose of exploring mathematics while others, designed to teach aspects of physics, also lent themselves to the study of mathematics. Under the guidance of Exploratorium personnel, the teachers used the exhibits to investigate mathematical theories and principals. Although the Institute focused on the enjoyment of the exploration rather than on its immediate application in the classroom, an essential feature of the intensive four-week program was the integration of the Exploratorium exhibits into teachers' learning processes.

Institute participants gained an appreciation of the interdependence of the scientific and mathematical disciplines. This was facilitated by the class interaction between the Exploratorium staff and district mathematics teachers, and by the presence of members of the Science Collaborative, who were participating in Exploratorium summer workshops.

Four of the more experienced collaborative teachers also participated in independent study to research and develop their own projects under the direction of Dr. Thomas Humphrey, faculty member of the Exploratorium Teacher Institute. Two of these teachers continued a project they had begun the previous summer on developing techniques to determine ordinance products. Their work produced a computer program that is part of a current Exploratorium exhibit. All four of the teachers began to develop worksheets that demonstrated the applicability of their research to classroom projects, and a collection of worksheets was compiled by two of the teachers. Some teachers did not complete the worksheets during the summer and continued to work on them during the year. When completed, the worksheets will be distributed to all district mathematics teachers as part of a complete booklet detailing teacher research from the last four Summer Institutes.

Teacher response to the Exploratorium workshops and independent study opportunities was very positive. One teacher stated: "Teachers are so positive about their Exploratorium experiences because the staff is so wonderful. They [Exploratorium staff] are excellent teachers, and as teachers, they understand other teachers and are willing to give us the respect and admiration we deserve. The Exploratorium's programs are designed to engage us in experimental play and not textbook learning; this results in our increased desire to apply our experiences to classroom activities."

### Exploratorium Follow-Up Workshops

Teachers who participated in the 1988 Summer Institute and previous Institute graduates were invited to attend three follow-up workshops in the fall, 1988. At the workshops, teachers were provided the opportunity to continue their exploration of the mathematics problems in the Exploratorium exhibits and to discuss the classroom applications of their insights. Approximately 15 teachers attended each of the workshops. Teachers received a $50 stipend for each session they attended.

## Workshops and Seminars

During the 1988-89 school year, the collaborative sponsored a variety of workshops designed to address mathematics teachers' interest in the connections between mathematical theory and application in the areas of industry and technology. Many of the workshops were offered cooperatively with other educational institutions, reflecting the collaborative's goal to create working relationships with other organizations that also help teachers gain insights into how their classroom curriculum is translated into important "real-world" scientific and mathematical activities.

## SCI-MATH Program

On Saturday, September 24, the collaborative, in cooperation with the San Francisco Unified School District, sponsored a workshop on the SCI-MATH program. Presented by Mr. Jim McAuliffe of the Education and Technology Foundation, SCI-MATH is an exemplary problem-solving curriculum organized as a collection of workbooks that helps students to connect abstract mathematics operations with real-world applications in the sciences and in everyday activities. The curriculum teaches 7th-12th grade mathematics and science students to use proportions beyond simple problems, to solve word problems, and to apply mathematics to the real world. The program, which was developed with the aid of a grant from the National Science Foundation, is especially suited to Math A, Beginning Algebra, and Science students. The workshop originated from a teacher's proposal to the Teachers Council.

Twenty-six teachers representing nine high schools participated in the workshop, which was held from 9 a.m. to noon at San Francisco State University. The collaborative paid a stipend of $25 to each workshop participant. In addition, teachers were given ten copies of the SCI-MATH modules, courtesy of the collaborative and the Education and Technology Foundation, to take back to their home schools.

Teachers were enthusiastic about the presentation, and many have since reported that they have successfully integrated elements of the SCI-MATH program into their teaching.

## Applied Mathematics: Simulation of a Biological System

On Thursday, October 24, the collaborative and the San Francisco Unified School District presented a workshop entitled "Applied Mathematics: Simulation of a Biological System." Dr. David Ellis of the Mathematics Department of San Francisco State University described the Applied Mathematics Program at San Francisco State

University and discussed some of the projects his students have worked on over the past six years. He explained how the program stresses team learning, problem solving, mathematical modeling and communication skills. Dr. Ellis showed how his students simulated a dynamic biological system by developing a mathematical model of the system and pointed out the possible ramifications that this work has for the study of communicable diseases, such as AIDS.

Approximately 15 teachers attended the seminar, which was held at 4 p.m. at San Francisco State University. The teachers, who did not receive a stipend for attending, were extremely positive about the workshop.

## Proposal-Writing Workshops

The collaborative sponsored proposal-writing workshops for teachers interested in submitting mini-grant proposals. Mini-grants of up to $1,000 are available from the Education Fund for projects designed to improve education in the San Francisco schools. Workshops on proposal writing were organized by the FUND for teachers in all content areas. The collaborative advertised the workshops and encouraged mathematics teachers to attend.

The first workshop, held at 3:45 p.m. on September 25, 1988, at Marina Middle School, was conducted by Education Fund staff members who explained the guidelines for submitting a proposal. Similar workshops were held October 4 and October 5.

## Geometry in Architecture

In November, 1988, Ms. Susan Kelley, a collaborative teacher, presented a workshop "Geometry in Architecture." Ms. Kelley had received a grant for the workshop from the FUND's Small Grants to Teachers Program. Four teachers, as well as Dr. Marcucci and Ms. Santos, participated. The workshop was designed to show high school mathematics teachers in San Francisco how they can draw upon the city's rich architectural heritage to make the study of geometry more meaningful to their students. The project was stimulated by a collaborative-sponsored program in December, 1987 that featured a presentation by William Blackwell on geometry and architecture. Grant funds were used to purchase Mr. Blackwell's book for distribution to participants. Ms.

Kelley consulted with Mr. Blackwell in planning the workshop. Plans were made during the year to interest more teachers in attending workshops on this topic.

## Activities of the San Francisco Math Teachers Association

During the 1988-89 school year, the collaborative continued to develop its relationship with the San Francisco Math Teachers Association (SFMTA). In addition to collaborative teachers' participation in activities sponsored by the SFMTA, the collaborative invited a representative of the San Francisco Math Teachers Association to serve on the Council, and Collaborative Director Bob Marcucci attended regular meetings with SFMTA and school district representatives to discuss critical issues that affect district mathematics teachers.

## Newsletter

Rather than continuing to publish its own newsletter, News by Degrees, the collaborative decided in the spring of 1988 to work cooperatively with the San Francisco Math Teachers Association (SFMTA) to produce the SFMTA publication, The Exponent. The Exponent's production and school distribution are supported by the San Francisco Unified School District.

The first issue of the joint publication was printed in the fall of 1988. The newsletter expanded its format to eight pages, including two and one-half pages of collaborative news prepared by contributing editor Bob Marcucci. The Exponent's other staff include Editor-in-Chief Bob Knopp of Washington High School, who is responsible for the senior high information and overall finished product; Assistant Editor Richard Shapiro, who covers the middle schools; and Assistant Editor Siva Tardos, who covers happenings at middle and elementary schools. The newsletter is distributed to the collaborative mailing list, which in the spring of 1988 included only secondary teachers, as well as to all members of the San Francisco Math Teachers Association.

## Power in Your Pocket

The San Francisco Math Teachers Association and the University of San Francisco co-sponsored a fall program for all area mathematics teachers. The program, "Power in Your Pocket," featured presentations by five calculator companies, and provided teachers with the opportunity to try out the latest calculators and calculator material, including overhead projector calculators, graphing calculators, and programmable calculators. The presentations were preceded by a short meeting of the SFMTA. Approximately 60 teachers, including some middle school teachers, attended the event, which was held from 4-6 p.m. at the University of San Francisco.

## Euclid's Birthday Party

Approximately 30 teachers attended the San Francisco Math Teachers Association's annual potluck dinner on Euclid's Birthday, May 19. The event provides an opportunity for secondary mathematics teachers to share ideas, elect new officers for SFMTA, and discuss the association's directions and goals for the next school year.

## Grant Awards Program

During the 1988-89 school year, the San Francisco Education Fund offered three types of grant awards to teachers: Mini-Grants, Small Grants, and Team Grants. The collaborative publicized the FUND's Grant Program and encouraged teachers to apply. The collaborative advertised three proposal-writing workshops in the fall of 1988 and offered ongoing assistance to teachers interested in writing proposals. In 1988-89, a total of 43 grants for mathematics projects were submitted and 22 were funded. In addition to supporting the Grant Program sponsored by the FUND, the collaborative awarded 31 Travel Grants to teachers who wished to attend the Asilomar Mathematics Conference, the NCTM Regional meeting in San Jose or the Annual Meeting of NCTM in Orlando, Florida.

## Mini-Grants

During the 1988-89 school year, the San Francisco Education Fund offered mini-grant awards to teachers. Two types of mini-grants of up to $1,000 each were offered for one-semester projects to be implemented in spring, 1989: Experimenter Awards, which are one-time awards to fill a need discovered after school has started and for which funding is not available; and Adaptor Awards, which are granted to teachers who want to take a project being disseminated through the Fund and adapt it creatively to meet a school's particular needs. Proposals were due October 24, 1988 and grants were announced in February, 1989. In 1988-89, 11 mini-grants were awarded. These funds were used to purchase manipulative materials, calculators, equipment, books, EGA/Hercules Cards for a computer, and other materials.

## Small Grants to Teachers

The San Francisco Education Fund's Small Grants to Teachers Program provides teachers with supplemental funds to implement creative classroom projects. The program is open to teachers in all grade levels in all curriculum areas. The Education Fund pledged a minimum of $36,666 to be used for awards to mathematics teachers.

During the fall semester of 1988, nine projects were implemented with Small Grant funds. Awards of $2,000 each went to principals at three elementary schools to develop mathematics leadership related to implementing the California Mathematics Framework. One grant was awarded to a pair of elementary teachers to strengthen the mathematics and science program in their school through a language-based curriculum. Grants were awarded to secondary teachers to fund the following projects: "Hands-on Math," "Geometry in Architecture," "Development of a Pre-Engineering Program," "Overhead Projectors for the Mathematics Department," and "Teaching Understanding in Math A."

## School Team Grants

During the 1988-89 school year, the collaborative, through the San Francisco Education Fund, initiated a trial program for awarding School Team Grants of $5,000. These grants, modeled after the Los Angeles +PLUS+ Team Grants, are awarded to mathematics departments for projects designed to identify and address high priority needs throughout the department or the entire school. The projects are to be planned through the cooperative efforts of the principal, assistant principal, department head and teachers. The team must include four to six teachers and be directed by a department head, principal or assistant principal. In addition, the involvement of parents, students, community members and other central staff is expected. After a team submits a preliminary application, the Education Fund schedules two planning meetings and a leadership meeting to help guide the team through the process. Teachers are paid $15 per hour or $60 per day to attend these meetings.

In the spring of 1989, Team Grants were awarded to two schools, but only one decided to pursue the grant. Raoul Wallenberg High School had identified a need for students to experience greater success in problem-solving techniques, probability and statistics, ratio and proportion, and graphing. The school's project was to institute a more integrated and relevant interdepartmental approach to both the teaching and learning of mathematics and science. Simultaneous instruction will be provided using cooperative learning, and teachers will receive training to help them improve their instruction. The program will be implemented during the 1989-90 school year.

## National Teacher Examination Preparation Course

The National Teacher Examination Preparation Course, a cooperative effort of the collaborative, the SFMTA and the San Francisco Unified School District, is designed to help teachers interested in obtaining a credential in mathematics prepare for the national exam. The course was offered from 9 a.m. to noon on Saturdays from May 21 through July 2, 1989, and from 4 to 5:45 p.m. Thursday afternoons from May 12 through June 9. It provided a review of the content from a range of mathematics courses including calculus, trigonometry, logic, probability, and discrete mathematics.

In planning for the course, high school teachers were surveyed to determine the level of interest. While 40 high school teachers had indicated an interest, only 25 high school and middle school teachers enrolled. Each participant received a stipend of $250. The course was an outgrowth of monthly meetings in which representatives of the three organizations discussed critical issues that affect mathematics teachers in the district. Funds were provided by the SFUSD, and Dr. Marcucci arranged for participating teachers to receive college credit from SFSU on an individual basis.

## The STAMP Project

As a result of the networking activities fostered by the collaborative, three teachers cooperated in developing a proposal to the National Science Foundation for an innovative mathematics project to address the mathematics needs of minority children. During the 1987-88 school year, the teachers had worked with Professor Uri Treisman of the University of California at Berkeley to develop a plan to improve the mathematical skills of minority students and to develop a model mathematics curriculum. The group focused its efforts on the transition from middle to senior high schools. Ms. Hernandez-Heinz was granted a sabbatical from the school district during 1987-88 to develop the program. At the end of the summer of 1988, the teachers submitted a proposal to implement the STAMP (Students and Teachers Acquiring Mathematical Power) Project. Through this program, high-risk students will be given the opportunity to attend summer school prior to entering ninth grade to take a course based on both Math A and first-year algebra courses. Once they enter ninth grade, students in the program will be clustered in classes taught by teachers who also participated. The STAMP Project received funding from NSF in spring, 1989 and program implementation was to begin in the summer.

## Regional and National Conferences and Follow-Up Workshops

The collaborative awarded travel grants to support teachers' attendance at regional and national conferences. Teachers who receive travel grants are expected to share their experiences and knowledge by participating in a follow-up workshop.

### Asilomar Mathematics Conference

The collaborative's Teachers Council awarded travel grants of $125 each to seven teachers to attend the National Council of Teachers of Mathematics California Statewide Conference in Asilomar, California, on December 2-4, 1988. The Teachers Council developed criteria for selecting teachers and then sent applications to each secondary mathematics teacher in the district. Topics discussed at the conference ranged from applied mathematics to innovative networking strategies to the future role of mathematics collaboration nationwide.

In February, the seven teachers who attended the Asilomar Conference presented a workshop for their fellow teachers and other mathematics colleagues who had been unable to attend. They conducted a roundtable discussion in which they presented an overview of the conference highlights, shared their experiences and information, and described innovative classroom projects that had been presented. Approximately 40 teachers participated in this workshop, which was held at the California Academy of Sciences. The collaborative publicized the event and paid for refreshments.

### Regional NCTM Meeting

All of the 14 teachers who applied received travel grants of $75 each to attend the NCTM meeting in San Jose, California, on February 23-25. In May, seven of the teachers presented a program to other collaborative teachers in order to share the information that they had learned at the conference.

### Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

Ten collaborative teachers were awarded travel grants to attend the annual meeting of the National Council of Teachers of Mathematics in Orlando, Florida, April 12-15, 1989. One of the recipients was not able to attend the conference, but each of the other nine teachers received $500 to help cover expenses. Four additional collaborative teachers attended the conference with funding from other sources. Teachers had to use sick leave to cover the cost of substitute teachers.

The theme of the conference was "Vision for the World of School Mathematics." During the day, the teachers attended a wide variety of sessions. In the evening, the teachers participated in sessions with members of the other ten collaboratives from across the country. The evening sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Curriculum and Teaching Program.

On May 3, 1989, from 4-6 p.m., the nine teachers who had attended the NCTM Annual Meeting presented a workshop to share the information and materials they had received with other teachers in the district and to motivate them to apply for travel grants to attend conferences. All K-12 mathematics teachers were invited to attend the workshop, which was held at the Fort Funston Environmental Science Center. Thirty collaborative teachers, the collaborative director and one school administrator participated. After the workshop, several teachers commented that they enjoyed the workshop. A curriculum leader who attended the workshop expressed concern that there was little interaction between elementary and high school teachers. The on-site observer reported, "It was casual, people seemed to have a good time. Teachers were most interested in solving interesting problems, and not so interested in discussing pressing issues in math education, but I thought that was to be expected, given the time of year and the setting for the workshop." He went on to observe, "People did meet teachers they'd never met before and I think the few (five or so) elementary teachers who attended felt welcome enough and had a good time."

## E. Observations

### Project Management

The San Francisco Mathematics Collaborative underwent a major restructuring during 1988-89, prompted by the Ford Foundation's rejection of the permanence proposal submitted by the San Francisco Education Fund in May, 1988, and subsequent grant of a four-month period for an extended permanence-planning process. The Ford Foundation granted the FUND $17,000 to continue to provide activities for teachers, but not to support the planning process. The need for reevaluation, the process that produced a new organizational structure, and the new structure itself all offer insight into the San Francisco collaborative in particular, and into the collaboration process in general.

The proposal submitted by the FUND in May, 1988, described the accomplishments of the collaborative, as well as the major challenges it faced. The proposal was written with input from the Steering Committee and Teachers Council and was approved, along with the budget, by the FUND Board of Directors. The vision presented in that first proposal focused on a process that would involve all project participants in joint planning over the next two years. The accompanying budget proposal provided funds to maintain the current administrative structure and to support current activities. Essentially the proposal was a continuation of what had been done in the past, with the expectation that more permanent plans would be developed over the two years.

The Ford Foundation was concerned that the proposal did not include a plan to institutionalize the collaborative and did not provide evidence that the collaborative was on the way to developing one. The FUND was informed as to the specific criteria that would be used to judge a revised proposal. These criteria included: presentation of a coherent vision for the collaborative; a set of activities for implementing that vision; evidence of continued, and broadened, teacher involvement, leadership, and control; and demonstrated commitment and involvement from the school district and the business community.

A combination of factors contributed to the perception that the collaborative lacked a coherent vision and plan in its first proposal. First, responsibility for the collaborative was shared rather than residing with any one person or group. The FUND's Director of Programs and Evaluation, who might have assumed this responsibility during the proposal-writing process, was on leave. The responsibilities of the part-time collaborative coordinator focused primarily on overseeing activities rather than on assuming full administrative responsibility for the project; the Teachers Council focused on issues related to teachers and planning activities. While the Steering Committee planned and approved collaborative activities, it was not formally organized to set collaborative policy. Policy and budget decisions fell under the purview of the FUND's Board of Directors, but the Board was removed from the collaborative's daily operations. Underlying the concept of collaboration is shared involvement. This concept seemed to be applied to the administrative and governing structure of the collaborative, so that there was shared administrative involvement from the varied sectors and organizations. But in the process, the people and groups involved had the tendency to attend primarily to the issues that reflected their own areas of interest, and no single group or person assumed an overriding, broad responsibility for the collaborative as a whole.

Another factor that seemed lacking was a sense that the involved parties were firmly committed to the concept and value of collaboration. The FUND's Board of Directors could not reach consensus that the FUND should make a long-term commitment to support the collaborative as the Board had a tradition of serving as a clearinghouse for funds to support small grants to teachers and schools. A decision to operate a collaborative permanently is a major commitment of resources for a non-profit organization that has to solicit its own funds. While the SFUSD administration had been supportive of the collaborative throughout the project's three-year existence, the district's administration had not really been engaged by nor committed itself to a permanent relationship with the collaborative. A core group of supportive, involved teachers had developed, but it was unclear how widespread this support was among all of the secondary mathematics teachers. There also was the underlying issue of the relationship between the collaborative and the San Francisco Math Teachers Association. Some agreements had been reached, such as the cooperative venture in the SFMTA newsletter, but a formal relationship had not been established.

Intervention by a third party--in this case EDC and the consultant it engaged, Dr. Phil Daro--worked well to strengthen the necessary bridges of communication and to facilitate a process that brought people together to develop a coherent vision. This intervention was successful for at least three reasons. First, the collaborative had produced programs that were valued by teachers and by the district; the project was a resource that many wanted to make permanent. Second, as a neutral facilitator, Dr. Daro was able to meet with the SFUSD deputy superintendent and to sort out the district's perceptions of the collaborative's role and what the district would be willing to support. Access to district administrators of urban school districts is generally very constrained and limited. With the help of the consultant, ideas were consolidated and related to the needs of the district. The details then were worked out with those representatives of the school district who were more involved with the collaborative. A third reason for the facilitator's success relates to his skill and experience in working with groups. Dr. Daro's expertise in group processing and consensus building was very valuable. Under his guidance, it became possible for the collaborative, the district, and supportive community groups to articulate a coherent vision and an explicit plan for realizing their goals.

The collaborative experienced significant changes as a result of the restructuring. Its target audience was expanded to include teachers in K-12, a decision strongly supported by the district and by the elementary teachers who participated in the reorganization process. There is now one central decision-making group, the Collaborative Council, which is controlled by teachers. A full-time director has been appointed. An indication of the cooperation between the school district and the FUND is that the director's position will be administered and funded through the school district during 1989-90. This provides a means through which the district can fulfill a financial agreement with the FUND while it enables Ms. Dworkin to benefit from the California teachers' retirement program. In the future, financial support of the director's position will be shared equally by the district and the FUND. The FUND's Board of Directors has made a long-term commitment to the collaborative that extends over four years and includes funds that will cover some of the collaborative's administration costs. The school district has added another curriculum team leader. The two significant mathematics teachers organizations in San Francisco, the SFTMA for secondary teachers, and the San Francisco Mathematics T.E.A.M. for K-8 teachers, each have a representative on the Collaborative Council. It appears that the collaborative is becoming an integral, valuable member of the professional mathematics community in San Francisco.

All teachers of mathematics, K-12, now have access to the decision-making process through the teacher representatives who were selected to serve on the Council. This organizational structure provides a mechanism by which teachers can become informed about the collaborative and its activities and vision. Selecting leaders through the election process is not new to teachers in San Francisco, since this procedure is also used to identify mentor teachers.

Some details of the collaborative structure remain unclear; it is not certain, for example, whether members of the Collaborative Council should be replaced or rotated. What is clear, however, is that the process involved participation by a large number of people, and resulted in changes not only related to the collaborative, but to the district and to the FUND's conception of itself as well. The cooperative efforts of the district and the FUND to maintain the collaborative's program through the transition period until a director was appointed exemplifies the closer relationship that has developed.

## Collaboration

Concomitantly with the changes in structure have come shifts in the form of collaboration. The process of developing the permanence proposal was a clear example of collaboration among all sectors. As many as 50 people attended meetings to discuss the collaborative and its future, including teachers, district administrators, FUND representatives, faculty from higher education institutions, and business people.

As the collaborative has expanded until it has the potential of including 1,500 teachers of mathematics K-12, interaction among teachers has broadened as well. Teachers from different grade levels are now working together, although initial efforts to foster cooperation and collegiality between elementary and secondary teachers met with a certain amount of resistance. On the Collaborative Council, members who represent teachers in grades K-8 have equal status with those who represent 9-12 teachers. This, along with the efforts by teachers from both levels to try to accommodate each other, has strengthened the working relationships among Council members. In addition, the one-day mathematics conference coordinated by elementary teachers in spring, 1989, and their participation in such programs as the Bay Area Mathematics Project, have helped foster mutual respect between the two groups. By the end of the 1988-89 school year, some progress was being made in bringing teachers from the elementary, middle, and secondary levels together. Even so, some uneasiness remained, due in part to the longstanding segregation of these groups of teachers in the teachers' unions and in the professional mathematics teachers' organizations.

Members of the higher education community continued to be active in the collaborative both by participating in its governance and in presenting workshops for teachers. One reason for this continued involvement is the high priority that local university and college faculty place on providing services to the broader community. San Francisco State University, for example, gives recognition to faculty members who provide such community service as workshops and seminars. Collaborative Coordinator Bob Marcucci was instrumental in establishing a review course to help teachers pass the National Teachers' Examination; participants received university credit for enrolling in the course. The STAMP project, which was funded by NSF and developed through the efforts of Ms. Hernandez-Heinz of the SFUSD and Professor Uri Treisman of the University of California-Berkeley, represents another form of collaboration in San Francisco between the higher education community and teachers.

Despite these gains, some forms of collaboration waned during the 1988-89 school year. A summer institute offered by the Exploratorium during 1988 provided a unique opportunity for teachers to use their knowledge of mathematics and teaching to help the Exploratorium plan and develop exhibits. The Exploratorium did not offer the institute during the summer of 1989 and the Exploratorium representative to the collaborative did not participate in the Council meetings toward the end of the year. The active relationship between the collaborative and the Exploratorium is one area that has suffered as a result of the energy and time put into restructuring. Collaboration with representatives of the business sector was also less evident. In the past, the Chevron Dinner Lecture Series has been a highly visible, very popular activity for teachers that was supported by business. The series ended in spring, 1988, and has not been reestablished. Representatives from the business sector were active in planning for permanence during the fall, but did not actively participate during the last half of the 1988-89 school year.

## Professionalism

Teachers have assumed a greater sense of control as well as ownership of the collaborative as their representation increased on the Collaborative Council. The Council has evolved from a group of teachers brought together by the coordinator as needed, to a governing body whose members were appointed by the coordinator from among the most active collaborative teachers, and finally to a Council controlled by the elected representatives of the 1,500 K-12 mathematics teachers in the district. Thus, teachers have increasingly assumed more of a decision-making role in the collaborative. The fact that they were integral to the process of developing the permanence plan is reflected in the collaborative's goal "to provide a 'safehouse' where teachers can freely express their needs and concerns."

The collaborative has continued to provide teachers the opportunity to participate in professional activities and to become more professionally involved. The collaborative also has funded teachers' attendance at conferences, offered mini-grants to help teachers initiate projects, and offered a variety of other development activities. Some teachers have taken the initiative to build on these experiences in order to increase their impact. The teachers who received funding to attend the NCTM Annual Conference in Orlando, for example, presented a workshop for their colleagues upon their return. Another teacher credits the collaborative's activities as the force that caused him to work with a science teacher to win a grant to develop mathematics and science instructional materials. As a new teacher, he had participated in three of the Exploratorium summer institutes. He credits them with awakening his interest in the relation between mathematics and science, which in turn led to his participation in other projects. This teacher has become involved in a national project to prepare mathematics and science software, and, for the first time, he submitted an article that was published in the Mathematics Teacher.

One concern that needs to be addressed is the expansion of the number of teachers actively involved in the collaborative. Approximately 30 teachers from each of the three grade levels (K-5, 6-8 and 9-12) participated in the April election for representatives to serve on the Council, far short of the number of collaborative teachers. The collaborative must develop activities that will attract teachers from the full range of grade levels and define an explicit strategy for expanding the number of collaborative participants. A true test of the viability of the structure for permanence will be its capacity to provide a "safehouse" for teachers and to involve them in leadership roles in the improvement of mathematics education.

### Mathematics Focus

The mathematics focus for the collaborative continued to be responsive to the interests of individual teachers. At its last meeting of the year in May, 1989, the Collaborative Council suggested that a coherent program of activities related to the NCTM Curriculum and Evaluation Standards be developed in 1989-90 to facilitate collegiality across the district and unify K-12 teachers of mathematics. Consistent with this theme, the Council stressed the importance of the collaborative coordinating its activities with those of the SFUSD, the San Francisco Mathematics T.E.A.M. and the SFMTA.

Although the collaborative's major focus during the 1988-89 school year involved establishing a viable administrative structure, several mathematical themes emerged in its activities and grant programs. It is difficult, nonetheless, to identify the precise connection between these themes and the collaborative's long-term vision. One recurring theme, for example, was a widespread interest in the California Framework and Math A. Three elementary schools received grants during 1988-89 to develop mathematics leadership in the schools based on ideas from the California Framework. Another elementary school received a grant to hold a student mathematics fair involving topics from the Framework. Although these grants were proposed and acquired before elementary teachers were involved in the collaborative, they can serve as an indicator of teachers' interest in the Framework, an interest upon which the collaborative can build. At the secondary level, an active collaborative teacher received a grant to conduct after-school symposia to help her mathematics department colleagues achieve students' understanding in Math A. This program, a predecessor to the STAMP program, is one example of an active collaborative teacher identifying a need and taking action to help meet it. Prior to the collaborative, the FUND received only a very small number of grant applications for mathematics-related projects.

Another theme apparent during the year emerged in activities that explored the relationship between mathematics and science. During the Exploratorium Summer Institutes, mathematics teachers prepared worksheets relating mathematics to the science exhibits in the museum. In 1987-88, the collaborative prepared a booklet of worksheets that focused on the mathematics of such exhibits as a pendulum, dropping balls, water spinner, and a hand-crank generator. As has been noted, a teacher who attended three of the institutes was energized and encouraged by his experience enough to get involved in a project preparing computer software for instruction that related mathematics and science. Another collaborative teacher came to the Teachers Council to propose a Sci-Math workshop, which was conducted in September, 1988. A teacher who attended this workshop received a FUND grant to implement the Sci-Math curriculum in the spring, 1989. In his proposal rationale, the teacher described his involvement in the collaborative and his attendance at the workshop as motivating factors in his decision to apply for funding. During the year, SFUSD was designated as one of the sites for Project 2061, and as such will be involved in developing a science-mathematics curriculum. A team of mathematics and science teachers began working on this project in 1989 and will continue until 1991.

Mathematics applications has been another recurring topic. The collaborative and the SFUSD co-sponsored the workshop "Applied Mathematics: Simulation of a Biological System" in October. The theme also emerges in a workshop on geometry in architecture, organized by an active collaborative teacher. The FUND awarded the teacher a grant to purchase books to distribute to participants who attended the workshop.

A fourth theme that was beginning to emerge was the use of technology in the teaching of mathematics. The collaborative encouraged teachers to attend a fall program featuring presentations by five calculator companies that was co-sponsored by the San Francisco Math Teachers Association and the University of San Francisco. The collaborative also began to organize a graphing calculator workshop that will be held in 1989-90. The FUND approved a grant on graphics applications for mathematics that will provide a teacher with the equipment for presenting classroom computer demonstrations in calculus, statistics, and computer sciences classes. Grant proposals approved by the FUND for the 1989-90 school year included using a computer as the key to mathematics success, and using calculators to enrich the Math A curriculum.

The collaborative director and the district's mathematics curriculum team leaders share an office and work very closely together. This creates a close tie between the district's activities and the efforts of the collaborative. Today, in the district's energized mathematics program, two people serve as district mathematics leaders and work with a collaborative director who is partially funded through the district. The district has become a part of Project 2061 and is seeking other ways that it can become involved in national mathematics projects. Teachers are talking about coherence in the K-12 mathematics program and thinking of ways to bring mathematics teachers together. Now that the structural decisions have been resolved, it will be interesting to observe the collaborative's impact on teachers' growing interest in mathematics and on the district's mathematics program.

## F. Next Steps

The Collaborative Council will continue to meet monthly. The two committees, Issues and Program, will each meet for one hour and then will meet jointly for an hour once each month. The collaborative's future activities will be guided by its goals, including the dissemination of the NCTM Curriculum and Evaluation Standards, K-12 articulation, communication, and equity. A single-sheet newsletter will be distributed monthly to collaborative teachers. One side of the newsletter will contain a calendar of collaborative events and a listing of Bay Area mathematics activities such as workshops and conferences. The other side will present articles about what teachers are doing in their classrooms, articles by teachers who have received grants, copies of CMC CoMmuniCator articles, information about interesting research or activities, and a Problem of the Month.

A number of collaborative activities are planned for the 1989-90 school year. Four San Francisco mathematics teachers will attend the UMC Teacher Leadership conference conducted by EDC in August. The collaborative will sponsor a one-week institute, "Functions 2," August 14-18, 1989, with themes that include: the impact of technology, new directions in content and teaching, computer software, visualizing functions, developing mathematical models, and solving real-world problems. In summer, 1989, the STAMP project will offer its first summer school session for students and teachers from three high schools. A fall kick-off event at which Professor Randall Charles of San Jose State University will discuss problem solving is scheduled for October 4, 1990. Two workshops will be held at City College in the fall. K-6 teachers will be invited to a workshop on enrichment activities tentatively scheduled for October 14, and teachers of grades 5-9 will be invited to a workshop on discrete mathematics, tentatively scheduled for November 18. The collaborative will continue to offer travel grants to conferences and follow-up workshops presented by the teachers who attend. The collaborative, the San Francisco Mathematics T.E.A.M., the SFMTA, and the SFUSD will co-sponsor an after-school mathematics conference on March 7, 1990. The goals of this conference are to facilitate communication among teachers in the district; to focus on the NCTM Standards; to give teachers an opportunity to provide leadership in mathematics education; and to focus on particular issues in mathematics. Both Small Grants and School Team Grants will continue to be available from the FUND.

Other activities that the collaborative is considering include: preparing a resource guide listing specialties of teachers and of those from higher education; cross-grade visits; school-community partnerships; and programs related to equity.

# SUMMARY REPORT:
# TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

by the

Urban Mathematics Collaborative Documentation project

University of Wisconsin-Madison

## PURPOSE OF THIS REPORT

This report summarizes the activities of the Twin Cities Urban Mathematics Collaborative during the 1988-89 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Twin Cities Mathematics Urban Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting of representatives of all of the projects in Philadelphia in October, 1988; the directors' meeting in Boston in February, 1989; meetings held during the annual NCTM conference in Orlando in April, 1989; the UMC Leadership Conference held in Newton, Massachusetts, in August, 1989; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

# TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

## A. Purpose

The purpose of the Twin Cities Urban Mathematics Collaborative, as expressed in the original proposal, is to "extend the sense of professionalism among secondary school mathematics teachers, provide for their further intellectual stimulation and renewal, and establish collegial and professional relationships among the teachers and the wider mathematical community of the Twin Cities." During the first and second years of funding, the collaborative worked towards these goals; by fall, 1988, the collaborative had developed to the point that it was ready to direct its efforts toward refining its focus. This included addressing more sophisticated issues in mathematics, becoming more politically involved, extending the project's influence throughout the Twin Cities, and seeking avenues to ensure continuation of the collaborative project beyond the involvement of the Ford Foundation. Five specific steps have been identified to help the collaborative achieve its goals. They are:

1. involving teachers in activities that help them to exercise more responsibility for and control over their professional lives;

2. continuing to provide a broad range of mathematical activities that encourage ongoing participation in the collaborative;

3. expanding the base and scope of industrial involvement;

4. integrating groups and organizations involved in pre-college mathematics education into the collaborative; and

5. increasing the visibility and the stature of the collaborative in the Twin Cities, specifically within the school districts.

The Twin Cities Urban Mathematics Collaborative proposed a restructuring that would lead to permanence in its proposal to the Ford Foundation in June, 1988. It is envisioned that by 1992 the collaborative will become incorporated as a 501(c)3, private, nonprofit, tax-exempt organization. The proposal identified five main goals for 1988-89, while the new structuring was to be initiated. These included:

1. sponsorship of those organizational structures and activities that have been well received by teachers, including the Building Representatives, the publication of the newsletter, the dinner meetings of the Twin Cities Mathematics Society, as well as workshops, meetings on educational policy issues, and special summer institutes;

2. initiation of the transitional process that will establish a new governance structure;

3. filling the position of the part-time project coordinator and incorporating the use of volunteer help into the collaborative;

4. developing and implementing a strategy for fund raising from sources other than the Ford Foundation; and

5. initiation of the process of obtaining nonprofit tax-exempt status for the collaborative.

## B. Context

The Twin Cities Urban Mathematics Collaborative (TCUMC) encompasses two distinct city school districts, each with unique educational policies, school boards, and strengths and weaknesses. The Minneapolis/St. Paul area today has a total population of approximately 620,000, down 3 percent since the 1980 census. The estimated population for Minneapolis in 1988 was 356,000 compared with 371,000 in 1980; the estimated population for St. Paul in 1988 was 265,000 compared with 270,000 in 1980.

Although only 5.1 percent of the labor force in the Twin Cities has been categorized as racial minorities, minority students account for 44 percent of the public school enrollment. It is projected that by the year 2000, 49 percent of Minneapolis graduates and 39 percent of St. Paul graduates will be members of minority groups. The number of minorities enrolled in Twin Cities schools has increased by 6.5 percent since the 1986-87 school year, while the number of white students has increased by only 1 percent.

## Minneapolis Public Schools

The Minneapolis Public Schools (MPS) served a student population of 41,830 students during the 1988-89 school year. Student enrollment by 1991 is expected to reach 42,300 students, an increase of approximately 12 percent since 1983. It is anticipated that the majority of this increase will occur at the elementary level, which is projected to increase by 25 percent. The population at the secondary school level is expected to decrease by about 10 percent. During the 1987-88 and 1988-89 school years, Minneapolis had a net gain of 250 pupils from nonpublic schools and a net loss of 117 students to other public school districts.

Of the students enrolled in the MPS schools during the 1988-89 school year, 53 percent were white, 29 percent black, 9 percent Asian, 7 percent Native American and about 2 percent Hispanic, with Asians comprising the fastest growing minority group. In the 1986-87 school year, 52 percent of the total population was male and 48 percent was female. In 1988-89, 33 percent of students' families received AFDC and 44 percent were eligible for federally subsidized lunch programs. Six percent of the student population was categorized as Limited English Proficiency (LEP).

In 1988-89, there were approximately 11,000 high school students enrolled in the district. Of these students, 52 percent were white, 30 percent black, 9 percent Asian, 7 percent American Indian and 2 percent Hispanic. This total population represents a decrease in enrollment of about 8 percent since the 1986-87 school year. The high school population is served by seven senior high schools (9-12) and one alternative school (grades 9-12). High school graduation requirements include one full year of mathematics and one year of science that must be taken in grade 10, 11, or 12. MPS is the only district in the state with this requirement; other districts conform to the state requirement of one course in either mathematics or science while in grades 10-12.

The dropout rate for the 1986-87 school year was approximately 9.7 percent, with the majority of students (88 percent) leaving school in grades 10 through 12. Of those who dropped out, 53 percent were white. Minnesota is the only state in the nation with a graduation rate exceeding 90 percent; 91 percent of Minnesota high school seniors graduated in 1987. The Minneapolis City Council voted to pay $296,000 for a special summer school for 2,000 students who either failed district tests or who needed more credits to graduate. An underlying motivation for this action was to keep students off the streets during the summer months.

MPS employed 111 high school mathematics teachers in 1988-89. Thirty-nine percent were female and 61 percent were male. Of the total, 105 were white, three were black, two were Asian and one was Native American. All had earned at least a bachelor's degree, and two had Ph.D.s. Due to a Minnesota policy that students may receive credit for a course only if the teacher is certified for that subject area, 100 percent of mathematics teachers are certified in mathematics. All high school mathematics teachers in MPS schools are tenured.

Teacher salaries average approximately $35,000 per year, with a starting salary of $20,324. Contracts are renewed every two years; the next contract will cover 1989-91. All MPS teachers belong to the Minneapolis Federation of Teachers (MFT). The union takes an active role in school board campaigning, and allocated $20,000 to the 1987 school board race. About 13 percent of all MPS teachers are members of a minority.

To save the district money and to open up positions for minority teachers, the MPS district is implementing an early retirement plan. More than 1,000 of the district's 2,700 teachers are eligible for the plan, which pays teachers who have at least 15 years experience and whose age and years of experience total 85, a half-year's salary to retire early. At the end of the 1988-89 school year, more than 150 teachers announced their retirement under the plan.

Superintendent of Schools Dr. Richard Green resigned in March, 1988 to accept the position of Chancellor of the New York City Schools. Dr. Robert Ferrera, former superintendent of the Grand Rapids school district in Michigan, was hired in August, 1988. His reputation suggests that he supports stiffer graduation requirements, district-wide curriculum guidelines, and specialty schools.

The total budget for the MPS in the 1987-88 school year was approximately $164 million. Of this, approximately 47 percent came from state revenues (including $5.9 million to facilitate desegregation), and 53 percent from local monies. Only $400,000 came from the federal government and $100,000 from other sources. Expenditures for the 1987-88 school year totalled approximately $168.5 million, resulting in a $4.5 million deficit.

Projected expenditures for the 1988-89 school year totaled $178 million, requiring a budget reduction of $7.5 million. In addition, district administrators discovered that pupil projections were off by several hundred and the district would lose in excess of $1.5 million in state aids for the 1988-89 school year. Teacher salaries make up approximately 85 percent of total expenditures; therefore, approximately 200 secondary teaching positions were eliminated in June, 1988, subsequently reducing secondary school staffing by 17 percent. Further, MPS Superintendent Robert Ferrera will recommend $1.5 million in reductions to the district's central administration. This 21 percent reduction will eliminate 60 positions, about 20 administrative and 40 support staff. In an effort to reduce class size in Minneapolis schools, Superintendent Ferrara has proposed eliminating special classes for students who have trouble passing the district's benchmark tests, which are the focal point of the district's six-year effort to end automatic grade promotion. Teachers' salaries for these special classes cost the district about $3.8 million. This proposal will mark an end to the assignment of teachers and counselors to this remedial program, and would result in 135 teachers being placed in regular classrooms.

Over the next five to seven years, $20 to $25 million will be needed for building repair and maintenance for existing Minneapolis schools. About half of the 63 public school buildings in Minneapolis are more than 60 years old. With the extreme weather prevalent in the area, buildings tend to deteriorate more rapidly than in other parts of the country. It is estimated that by 1993, the district will need five more school buildings to serve 700 students each, at a total cost of approximately $30 million.

The General Mills Foundation has granted the MPS $300,000 to establish a K-3 Public School Academy. This three-year pilot program maintains a teacher-pupil ratio of 1:14. Each teacher is wholly responsible for her/his class; there are no specialists in art or music nor are there any remedial services. Parents and students are encouraged to call teachers at any time, and each teacher has a phone with an outside line in the classroom and an answering machine at home to facilitate this interaction.

Ray Harris, a Minneapolis developer, conceived the idea for a middle school in which students learn at various sites around the community, rather than in a conventional school building. Mr. Harris is leading the fund-raising efforts and has secured grants from foundations and businesses, including Honeywell, Incorporated to support the program, and the MPS is providing funds based on the district's average cost per student. The Chiron Middle School is slated to open in the fall, 1989, with 120 fifth and sixth graders; it is expected eventually to serve 300 students in grades 5-8. More than 200 students applied for the 120 positions. Class sizes will be limited to a teacher:student ratio of 1:20. The curriculum will be an enhanced version of the standard MPS curriculum, with teachers developing individual learning plans for each student, and students working in multi-age groupings.

A Minneapolis high school is among 30 schools nationwide that will participate in the first official student exchange between the U.S. and the Soviet Union. The school will host 10 to 15 students and one teacher from the U.S.S.R., beginning in February, 1989.

## St. Paul Public Schools

The St. Paul Public Schools (SPPS) encompasses 34 elementary schools (grades K-6), eight junior high schools (grades 7-8) and six senior high schools (grades 9-12). In addition, the district includes one open school (grades K-12), two K-8 elementary schools, one evening high school, one alternative school (grades 7-12) and pre-kindergarten schools for the handicapped. In 1988-89, the SPPS served a population of approximately 33,000 pre-kindergarten to grade 12 students.

The student population of the SPPS is 48 percent female and 52 percent male. Sixty-two percent of the students are white, 15 percent are black, 15 percent are Asian, 6 percent are Hispanic and 2 percent are Native American. Demographic trends indicate a shift from blacks to Asians as the predominant minority group. Eighteen percent of the students consider English a second language. Forty-four percent of SPPS students are eligible for federally funded lunch programs. About 26 percent of city students attend private schools. Twenty-three students have transferred into St. Paul schools under Minnesota's open enrollment policy, while 81 students have transferred from the St. Paul system to suburban schools.

Approximately 9,000 students attended SPPS high schools during the 1987-88 school year. Overall demographic data was unavailable in reference to ethnicity, gender or AFDC status. Thirty-eight percent of the students were new to their schools in the fall of 1987. In 1988-89, six new specialty programs were initiated by the district in five senior high schools: Gifted/Talented and Media Communication Specialty (Central High School); Business/Math/Science Technology (Como Park Senior High School); Chemical Technology Specialty and Graphic Communications Specialty (Harding Senior High School); and International Studies and Career (Humboldt Secondary Complex).

Graduation requirements for SPPS schools include one year of either mathematics or science in grades 10-12, as stipulated by state requirement. The dropout rate in 1987 was approximately 12 percent for grades 9-12. Criteria for considering a student as a dropout include either withdrawal from the district or absence of more than 15 consecutive days.

Students in the SPPS averaged in the 55th percentile on the ACT composite scale and in the 60th percentile on the ACT mathematics scale in 1987. In addition, scores on the SRA (Science Research Associates) Survey of Basic Skills indicate that approximately half of high school students in the SPPS score over the 50th percentile, thus approximating national norms. In 1988, ninth grade students in St. Paul scored higher on writing but lower in mathematics than in 1987.

The SPPS employ 102 high school mathematics teachers in 1987-88. Of these, 80 were male and 22 were female. Only two high school mathematics teachers are minorities; one is black, and no information is available pertaining to the ethnic heritage of the other minority teacher. All high school mathematics teachers have earned at least a bachelor's degree and over 75 percent have earned at least a master's degree. As with the MPS teachers, all St. Paul mathematics teachers are certified to teach mathematics and 90 percent have tenure. The average number of in-service days for high school mathematics teachers in the SPPS is four days during the school year and four days prior to the academic year.

The average salary paid to teachers in the SPPS system for the 1988-89 school year was approximately $32,500; a first-year teacher with a bachelor's degree earned $21,423. The contract for 1987-89 was not approved until January, 1988. According to Minnesota law, teachers pay dues to their respective bargaining agent whether they are members of the union or not; as a result, most SPPS teachers belong to the St. Paul Federation of Teachers (SPFT), the local active teachers' union.

Dr. David Bennett has been the superintendent of the SPPS district since 1984. By promoting elementary magnet programs, Dr. Bennett has generated a lot of enthusiasm to increase academic performance but the impact of these programs on regular elementary curriculum remains unclear. Dr. Bennett has worked to desegregate St. Paul schools. He has switched the city's magnet program from enriched general programs to specialty programs in order to attract students of all races to different school locations voluntarily. His approach has drawn angry responses from some parents who feel they are losing their neighborhood schools. Throughout 1988-89, Dr. Bennett garnered support for an area-wide desegregation plan that would include the surrounding suburban area.

The 1989-90 general budget for St. Paul schools is proposed at $184.4 million, a 6 percent increase over the 1988-89 budget. In a worst-case scenario, district revenues would total only $174.5 million. In 1988, district financial problems forced a reduction of $8.3 million, resulting in 80 fewer teachers. Per-pupil expenditures for the 1989-90 school year are projected at approximately $2,800, a 1.6 percent increase over the previous year. In St. Paul, more than 25 percent of existing school buildings are more than 50 years old. The district is seeking legislative support for deferred maintenance and building improvements totaling about $33 million. Leaking roofs are the worst problem.

In 1988-89, in an attempt to save money, St. Paul administrators planned to eliminate spring parent-teacher conferences at the secondary level. Parents and School Board members reacted angrily to the action, claiming that conferences are at the heart of parent involvement in the schools. Spring parent conferences were held, but were reduced from two nights to one.

The St. Paul Public School system has decided to charge a $100 fee for all enrichment courses offered this year in summer school. Students who are short of required credits may take summer school classes at no charge. A new school-business partnership, the St. Paul Compact, is considering sponsoring business-community mentors, guaranteed scholarships for college, matched savings programs for college education and money for top-rate attendance.

The district has a strong magnet school program. In addition to 17 elementary magnet programs, St. Paul Public Schools have 18 secondary magnet programs: six middle school/junior high, two 7-12 grades and ten high schools. Foci for these magnet schools include: Gifted and Talented Education, Media Communications, Performing Arts, Creative Arts, Business Technology, Mathematics, Science, Chemistry, Graphics, Chinese Language, International Studies, Banking and Finance, Humanities and an Open Magnet.

The school district is planning to open an experimental school, The Saturn School for Tomorrow. This school, which will have an enrollment of approximately 350 students, will rely heavily on computers and other technology. It is envisioned that students will work primarily at their own pace. The proposed St. Paul location for the school will cost approximately $1.8 million for the first year. School Board members are attempting to find a less expensive site for the school.

In a telephone survey of more than 200 St. Paul parents, designed to evaluate the school system, 76 percent of the respondents gave the school system a grade of an A or a B. Ninety percent said their child was getting a good education, and nearly 90 percent said that teachers care about their students and are competent. Seventy-eight percent said that the quality of education in SPPS schools was worth its cost in taxpayer dollars.

## Additional Information about the Twin Cities

Minnesota has an open enrollment program, which allows public school students to transfer to a school in any district as long as the transfer does not skew racial balances in desegregated districts and the school of choice has space. It is anticipated, for example, that about 2,000 students will transfer in the fall of 1989. While recent Gallup polls indicate that 70 percent of the U.S. public and 77 percent of minority parents favor open enrollment in public schools, minority parents and parents in lower economic groups do not choose elementary school alternatives under open enrollment nearly as often as do white or the middle-class parents. In Minnesota, the program, which is supported by Governor Rudy Perpich, has come under fire by school administrators who charge that students are changing schools for athletic rather than academic reasons. School officials also complain they can't make programming plans or set a firm budget because they do not know how many students will be enrolled until registration begins in the fall. To address these concerns, the state has agreed to investigate earlier applications for transfers and sports eligibility requirements.

Approximately 55,000 students in Minnesota are enrolled in special education classes at a cost of $150 million annually. Newspaper reports indicated that according to the criteria established by the State Department of Education, as many as 20,000 Minnesota youngsters may have been inappropriately placed in special education classrooms. The number of minority children in these programs is disproportionate to their percentage in the population.

Minnesota high school students have an opportunity to participate in the Minnesota State High School Mathematics League. Using a small grant from Sperry Univac (now Unisys), Wayne Roberts, Professor of Mathematics at Macalester College, helped to establish teams in the Minneapolis and St. Paul schools. In 1988 the League, under Professor Roberts' direction, had 168 member schools and more than 2,500 students took part in meets that culminated in a state tournament; 30 won places in two all-star teams that participated in national competition.

Students also may participate in the University of Minnesota Talented Youth Mathematics Project (UMTYMP) directed by Professor Harvey Keynes, Professor of Mathematics and Director of the Special Projects Office of the Mathematics Department at the University of Minnesota. Each year several hundred top mathematics students in grades 5-12 enroll in accelerated and advanced courses that meet after regular school hours. Despite a successful 13-year track record, the UMTYMP noted a disturbing historical trend: low female participation. The program was awarded a $132,000 grant from the Bush Foundation of St. Paul to attract and retain more females. This is the largest national effort to encourage and support talented girls to join and complete an accelerated mathematics program. In 1988, UTYMP drew 379 students from 153 schools in the Twin Cities area. Traditionally, 20 percent of the applicants have been female; new recruitment efforts have increased female enrollment by one-third.

Augsburg College plans to host Computer Camp for Junior High Girls in July, 1989, focusing on using PASCAL programming to design graphic displays. The camp provides girls entering grades 7-10 with a variety of computer experiences.

Under the Post Secondary Options Enrollment (PSOE) Act, Minnesota high school juniors and seniors are allowed to take college courses at state expense while still enrolled in high school. Although this may save the districts money in funding advanced mathematics courses, they have opposed PSOE because it diverts state money from the district to the colleges. During the 1987-88 school year, about 5,000 students took advantage of this innovative program. With proper course selection, students can leave high school with up to two years of college credit within a subject area.

Legislation introduced by State Senator Ember Reichgott would require the State Board of Education to create and administer standardized tests to measure comprehension of core material in science, social studies, mathematics and communications. The tests would be administered to 6th and 10th grade students as part of a program that would include district-by-district surveys recording size of schools, student-teacher ratios, teacher experience, and attitudes of teachers, parents and educators. The first State Assessment Tests to evaluate schools' adherence to the new state-mandated mathematics curriculum are already being administered. Six additional subject areas will be added by 1993. Support is growing in the Legislature to use the evaluation as a basis for school funding as one way to determine the return on the investment the state puts into its schools. The Minnesota Council of Teachers of Mathematics (MCTM) is organizing a task force to examine the State Assessment in Mathematics and to make recommendations as to the validity of the program. It is the intention of the Board of Directors of the MCTM to have a final report ready by October, 1989.

The annual teacher salary in Minnesota increased by 5 percent in 1987-88 and by another 5 percent in 1988-89. Currently, Minnesota ranks 11th in the nation, with an average teacher salary of $29,756.

A tax on charitable gambling is expected to generate $35 million that has been earmarked for public schools. An additional $17 million will be trimmed from another spending bill and allocated to the schools. These funds will increase the state's investment in education by $52 million in 1989. Per-pupil spending for Minnesota has increased from $2,755 in 1988-89 to $2,838 for 1989-90 and is projected to reach $2,953 by 1990-91.

The Alan Page Education Foundation was established at the end of 1988 to provide funding for minority students to obtain post-secondary education. Mr. Page, a former professional football player, was recently inducted into the Football Hall of Fame. In his induction speech, he stressed the importance of educating America's youth. Mr. Page is an attorney with the Minnesota Attorney General's office and a regent for the University of Minnesota.

**Professional Opportunities for Twin Cities Teachers**

Although budget cuts have detrimentally affected both school districts, these problems also have served as an impetus for the development of innovative programs that have been sponsored in part by business, university and community funds. The Minnesota Mathematics Mobilization ($M^3$), for example, is a statewide consortium of educators and others interested in mathematics education. The consortium operates under the co-directorship of Professor Harvey Keynes of the University of Minnesota, and Professor Lynn Steen of St. Olaf College, with the assistance of Project Coordinator Martha Wallace. $M^3$'s organizational structure also includes a Steering Committee comprised of representatives of business, industry, higher education, and the schools. In fall, 1988, the collaborative was invited to have a representative sit on the Steering Committee; Marvin Tromp, president of the Building Representatives Committee, was selected for this position. $M^3$, supported by a grant from the National Science Foundation, provided many opportunities for mathematics educators in the Twin Cities area during the 1988-89 school year, including such events as an all-day conference on equity in April, 1989. It also publishes a newsletter five times each year.

Mankato State University's Department of Mathematics, Astronomy and Statistics conducted the Second Annual Mankato Mathematics Symposium on April 7, with a grant from Cray Research Foundation of Minneapolis. The theme of the symposium was "Mathematical Problem Solving and Modeling." There was no charge for registration and teachers who attended were eligible to receive continuing education credits.

The local and state professional mathematics societies also offered a variety of opportunities for professional development. The Minnesota Council of Teachers of Mathematics (MCTM) co-sponsored a one-day workshop with the Minnesota Science Teachers Association [MSTA] during their annual teacher's convention, Friday, October 21, 1988. The theme of the conference, which was held at Normandale College, was "A Global Challenge: Math and Science--Passports to the Future." MCTM also co-sponsored a series of workshops around the state to help schools make use of the video series, Challenge of the Unknown, which was produced by the American Association for the Advancement of Science. The video series was developed to help junior and senior high school students better understand real life problem solving. The workshop series was funded through an EESA Title II grant. There was a registration charge of $10 per school, but in exchange participating schools received copies of the seven video programs and accompanying teaching guides. Workshops were held in the Twin Cities area on November 11 and January 12. The MCTM annual conference, held on April 28-29, 1989, was attended by nearly 500 mathematics teachers. In addition, MCTM publishes a quarterly newsletter that is distributed to all of its members.

The Minneapolis Math Club, an organization comprised of secondary and elementary teachers, sponsored three activities that were attended by many of the collaborative's teachers. The fall event was a walk around the Lake of the Isles with a barbecue at the home of Ross Taylor, mathematics consultant for MPS. On February 23, 1989, the Minneapolis Math Club sponsored a beer and pizza party at Green Mill Too, a local restaurant. Professor Ayers Bagley of the University of Minnesota Department of Education spoke on artistic representations of the liberal arts throughout history. Sixty K-12 mathematics teachers from the Minneapolis and St. Paul public and private schools attended. On December 8, 1988, the Minneapolis Math Club hosted approximately 200 people at a reception to honor the winner of the 1988 Presidential Award for Excellence in Science and Mathematics Teaching, Eleanor Matsis. Ms. Matsis is a 20-year veteran mathematics teacher in Minneapolis. She is the third Minneapolis mathematics teacher to win the award in the six years it has been granted. The two previous Minneapolis winners, Larry Luch and Ed Andersen, were also honored at the event. The reception was held at the Minneapolis Institute of Arts. An optional tour of the Art Institute, conducted by a systems engineer in IBM who has a degree in mathematics, was offered to participants.

The American Association for the Advancement of Science, the Minnesota Higher Education Coordinating Board and the Minnesota Department of Education sponsored a conference, "Minnesota Conference on Women and Minorities in Science and Mathematics." The conference, held September 23, 1988, in Bloomington, Minnesota, was supported by funds from the Bush Foundation and the Carnegie Corporation. More than 300 people attended the day-long program and more than 300 others were turned away because they didn't have an invitation. The program, which opened with a breakfast for state legislators, featured a morning session, "Awareness of the Issues"; a luncheon address, "An Overview of Intervention Programs"; and two concurrent afternoon sessions: "Programs that Work" and "Programs Focusing on Formal Science Education." A final session, "Making It Work in Minnesota," was followed by an informal reception at which participants had the opportunity to meet the speakers.

The Minnesota Federation of Teachers (MFT) held a conference October 20-21, 1988, to discuss empowering teachers to restructure the school environment. Ideas included combining courses and promoting direct parent-teacher collaboration. Programs mentioned as models included the Minneapolis Public School Academy, where teachers share decision making with the principal, and the St. Paul Saturn Project, in which teachers will plan the curriculum as a team, and will involve parents and students in the learning plan. An article in the Minneapolis Teacher newsletter, "The Results of Teacher Involvement in Decision Making: A State by State Profile" reported that the majority of teachers do not participate in staffing decisions, staff development and student placement, promotion and retention policies.

TCUMC teacher Dale Hulme has developed a mathematics curriculum for "math resistant" and "at-risk" students. The curriculum uses the LOGO programming language to develop mathematics skills, concepts and problem-solving routines. Students in the program indicated that they liked and understood mathematics better with this new program and planned to continue in mathematics.

Wayne Roberts, Professor of Mathematics at Macalester College, is directing a Calculus Reform Project on behalf of Associated Colleges of the Midwest and the Great Lakes Colleges Association. The NSF-funded project will develop resources to remedy commonly cited problems in the calculus curriculum. The project will focus on learning by experiment, developing textbook problems using new technology, applications in various fields, student projects, and the relationship between calculus and culture.

## C. Development of the Collaborative

The Twin Cities Urban Mathematics Collaborative was restructured in 1988-89 based on the four-year permanence plan that was developed during the 1987-88 school year. The new structure is based on a dual system of governance. One body, the Governing Board, is responsible for policy decisions and fund raising. The second body, formerly the Teacher Advisory Committee, was incorporated into the Building Representatives group, which was in turn reorganized to incorporate its own governing structure and to assume direct control over funds allocated by the Governing Board. Mathematics Professor Dr. Harvey Keynes, who is also Director of the Special Projects

Office of the Mathematics Department at the University of Minnesota, continues to provide administrative direction for the collaborative.

The Governing Board contracted with the Special Projects Office for part-time administrative and clerical support for the collaborative. Dr. Phillip Carlson, a retired mathematics professor from Bethel College who was working part-time for the Special Projects Office, became collaborative coordinator in November, 1988, continuing through the summer of 1989. His duties included preparation of a one or two page monthly information update that serves the function of a collaborative newsletter; the recording and distribution of the minutes of the Governing Board's and the Building Representatives' meetings; and a variety of other administrative tasks. Ms. Gerry Sell continues to serve as the collaborative's on-site observer.

The target audience for the Twin Cities Urban Mathematics Collaborative consists of the nearly 260 certified secondary mathematics teachers working in public, private, and parochial schools within the geographic boundaries of the cities of St. Paul and Minneapolis. Its members also include approximately 50 representatives of business and higher education, as well as others involved or interested in mathematics and mathematics education.

### Governing Board

The Governing Board of the Twin Cities Urban Mathematics Collaborative initially was a ten-member group, representing the various constituencies of the collaborative. Board members serve three-year terms. The Board is responsible for policy decisions, for fund raising, and for budgeting. Board members were selected from among former members of the Steering Committee, and nominees from the Building Representatives; new members were appointed by Administrative Director Harvey Keynes and Governing Board Chair Steven Watson. Mr. Watson, former collaborative coordinator and chair of the Permanence Committee, is the Executive Director of the Minnesota High Technology Council, and he represents this group on the Governing Board. The other nine members of the Governing Board include Professor Keynes, two teachers from the Building Representatives group, the two mathematics consultants (one from each district), two higher education representatives (one from the University of Minnesota and one from a small college), one business representative, and one member from the Minneapolis school board. With the adoption of the new Governing Board structure, Harvey Keynes' role transferred from project director to fiscal agent and administrative director. Steve Watson, as Board chair, assumed many of the responsibilities of a project director. Three other Board positions were created through the permanence plan, but by the first board meeting in December, 1988, people had not yet been identified to fill these positions. At this first meeting, the Board voted to establish a fourteenth position to allow inclusion of a private school teacher representative to be selected by the Building Representatives.

The Governing Board held quarterly dinner meetings on Wednesday evenings, generally from 6-7:30 p.m. Meeting agendas were set by Mr. Watson and approved at the beginning of the meeting. The meetings were conducted formally with strict adherence to specified time limits.

The Governing Board met for the first time on December 7, 1988, from 5-7 p.m. at the Coffmann Union on the University of Minnesota campus. Seven Board members attended. An executive committee of four people was appointed and included the chairperson (Mr. Watson), the vice chairperson (the business representative when appointed), the treasurer (Dr. Keynes), and the secretary (Ms. Eileen Aberman-Wells, a teacher). The executive committee planned to meet between Board meetings to implement approved collaborative policy and to address issues requiring immediate action. Professor Keynes made a financial report and presented collaborative plans for future activities. It was also reported that the publication of the newsletter, which would become a one or two page monthly information mailing, was to be the responsibility of the coordinator rather than a voluntary activity. A Building Representative report included an announcement of the membership of its executive committee. At that meeting: 1) the Board approved the disbursement of $1,500 to support a one-day conference to be scheduled in April or May, on the NCTM Curriculum and Evaluation Standards; 2) the size of the Board was increased from 13 members to 14 members to add one private school representative; 3) it was agreed that a contract would be made with the Special Projects Office to provide the TCUMC part-time administrative and clerical support for 90 days; 4) it was agreed that the Building Representatives group would be asked to invite Mr. Watson to discuss the Minnesota High Technology Council mini-grants program at one of its future meetings.

The Governing Board met for the second time on February 16, 1989, at the Holiday Inn Metrodome, Minneapolis. Nine of the 11 members who had been appointed to the Board attended the meeting. The meeting began with the approval of the agenda and minutes, followed by reports from the treasurer and a member of the Building Representatives. The Board adopted four motions regarding future activities and TCUMC support to attend conferences: 1) A nominal fee of $5 to $10 per event is to be charged for TCUMC activities. This action was taken because of the high number of no-shows by those who registered for some events. 2) Two additional teachers, beyond the eight already specified, will be granted $100 each towards their expenses to attend the NCTM Annual meeting in Orlando. 3) The Board will select two teachers to be funded by EDC (preferably Building Representatives, one junior high and one senior high) to attend the UMC Leadership Conference in Newton, Massachusetts in August, 1989. It is anticipated that these teachers will be a junior and a senior high Building Representative. In addition, a third teacher's attendance will be financed by TCUMC. 4) A Board position was added in order to include another representative from industry, increasing Board membership to 15.

The third meeting of the Governing Board was held May 10, 1989 at the Holiday Inn Metrodome. Eleven of the 13 Board members attended, including the newly identified private school representative. Minutes from the previous meeting and the financial report were approved. The Building Representatives' report outlined the group's concern about problems with the distribution of their minutes by the TCUMC coordinator and the limited relationship they have with the business community. The report also noted the need for summer collaborative activities for both junior high and senior high teachers. Mr. Watson reported on the statewide NCTM Standards press conferences held March 6-7, 1989 that were partially funded by TCUMC. Participants in this effort included TCUMC, the Minnesota High Technology Council, the Minnesota Department of Education, the Minnesota Mathematics Mobilization, the Minnesota Council of Teachers of Mathematics, the State University System, Cray Research, Northern States Power Company, and Unisys. The School Board representative suggested that the Board make use of an available list of local organizations that the collaborative could contact to generate financial support and to access statewide educational organizations. It was agreed that the issues of the Standards and equity merit TCUMC attention and concern. The Board announced the names of the three teachers selected to attend the UMC Leadership Conference and discussed future activities. Ms. Sell was asked to continue arranging and scheduling the Mathematics Society dinner meetings. Mr. Watson noted that the Executive Committee would begin to meet monthly. To facilitate brainstorming for the Board's plans, the Executive Committee will propose preliminary lists of possible activities for the year, distribute them to the Board members for comment and review, and prepare a proposal for adoption at the Fall, 1989, meeting. The Board voted to extend TCUMC's contract with the Special Projects Office for administrative assistance and clerical support retroactive from March 7, 1989, through September 30, 1989. After a lengthy discussion as to whether or not it was setting a precedent for expanding the collaborative membership, a certified Minneapolis special education teacher received approval to become a member of the collaborative.

During the year, the Board's Executive Committee made several decisions. The committee agreed to send all TCUMC members a questionnaire on equity that had been developed by the UMC Standing Committee; questions were sent to Building Representatives June 13, 1989, with the expectation that the teachers in the schools would respond by June 30. Responses were forwarded to the three Teacher Leaders to take to the UMC Leadership Conference in August, 1989. Survey questions included: How would you define equity issues in your city? How would you define these issues with specific reference to mathematics education? What are your perceptions of test scores, by gender, by race, by some other breakdown? Do you have a personal investment in dealing with these issues? Do you think others (in your building? elsewhere?) do?

### Building Representatives

The Building Representatives include at least one representative from each junior high school and senior high school in St. Paul and Minneapolis and from each of seven private and parochial schools, for a total of 36 teachers. The group was scheduled to meet monthly during the school year, except for November and December, weekdays from 4-6 p.m. In fact, the group met five times during the year: September 22, October 27, March 1, April 6, and May 9. In the spring, these meetings preceded the Twin Cities Mathematics Society dinner meetings.

Mr. Marvin Tromp, a mathematics teacher and former department chair at St. Paul Central High School, was elected to chair the group at its first meeting in September, 1988. When he was unable to continue with these duties after he suffered a stroke in December, Ms. Marlys Henke, a mathematics teacher and department chair at St. Paul Central High School, assumed the duties of interim chair. At the March 1, 1989, meeting, Ms. Ona Lentz, a mathematics teacher and department chair at North High School, Minneapolis, was elected chair. Attendance at the meetings ranged from 15 to

27 members, with an average attendance of 20. The Governing Board allocated $3,000 to the Building Representatives to spend during the 1988-89 school year as the group saw fit. By May, 1989, $400 of that money had been used. During its first year (1987-88), each Building Representative was awarded a stipend of $100 for participating in the meetings; no stipend was awarded to representatives in 1988-89.

One function of the Building Representatives is to select teachers to attend special functions and to make recommendations to the Governing Board as to the number of teachers whom the TCUMC should sponsor to attend particular conferences. Ms. Ona Lentz of North High School, Minneapolis, and Ms. Connye La Combe of Cleveland Junior High School, St. Paul, were elected to represent the TCUMC at the UMC annual meeting in Philadelphia. Three teachers were nominated to attend the UMC Leadership Conference in August, 1989, pending approval by the Governing Board: Ms. Ona Lentz, Ms. Karin Thul (Folwell Junior High School, Minneapolis), and Mr. Martin Gaslin (Humbolt Senior High School, St. Paul). In selecting these teachers, the group considered it valuable to send one veteran teacher and two newer teachers, as well as to achieve a balance between the two cities, and junior and senior high school levels.

A second function of the group is to disseminate information to teachers. In addition, time is spent at meetings discussing future activities. At the March 1, 1989, meeting, for example, the Building Representatives discussed the number of teachers who were to receive $100 to attend the NCTM Annual Meeting in Orlando, the upcoming Woodrow Wilson One-week Summer Institute, and the April 6, 1989 dinner meeting of the Mathematics Society.

The Building Representatives also discussed a variety of issues at their meetings. At the October 27 meeting, for example, the group questioned the amount of the stipend that was to be awarded teachers for attending the Woodrow Wilson One-week Summer Institute. One Building Representative said that offering a $200 stipend or two college credits for attending a week-long institute was inappropriately minimal and that $600 would be more adequate. This teacher compared the event with institutes of the 1960's, when a teacher often received $600 and six college credits. This opinion was quickly challenged by nearly all of the other teachers, however, who argued that it was a privilege to attend such a quality event. One teacher commented, "I would have paid to go." Another issue that was discussed was the number of teachers who should receive $100 to attend the NCTM annual meeting. The Building Representatives argued it should be eight teachers instead of the six originally proposed by the Governing Board.

Sometimes school issues were discussed, such as the documented guidelines for junior high acceleration in Minneapolis schools.

A key issue discussed at the May 9 meeting concerned the Building Representatives' communication with both the collaborative coordinator and the Special Projects Office. Although minutes of the Building Representatives' meetings were given to the coordinator to be typed and distributed, group members were not receiving them. The group also agreed that the procedure for gathering survey information from teachers should include a letter to the Building Representative in each school, asking him or her to distribute and collect the surveys. The group also discussed the job description for the coordinator's position and recommended that the successful candidate have a teaching background and that the job description include working closely with their group. Discussion also included suggestions for spending the funds that had been allocated to the Building Representative group; proposals included conducting workshops or programs on topics such as graphing calculators, or arranging for teachers to observe successful lessons to motivate under-achieving students either through classroom visitations or video. Although many of the suggestions had merit, the group agreed that it was too close to the end of the year to plan anything for 1988-89. The Building Representatives occasionally invited a guest speaker to their meetings. At the October meeting, for example, Dr. Paul van den Broek, a psychologist from the University of Minnesota, spoke to the group on information processing models of cognitive psychology and their relationship to memory. His presentation was well received by the group.

## D. Project Activities

During the 1988-89 school year, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for mathematics teachers designed to enhance their professionalism and to create collegial networks among teachers and representatives of business and higher education. The collaborative also encouraged teachers to participate in activities offered by other local, regional and national organizations.

## Twin Cities Mathematics Society Dinner Meetings

When the collaborative was established in 1985, the Twin Cities Mathematics Society (TCMS), initially called the Twin Cities Pre-College Mathematics Society, was formed to organize collaborative functions that would facilitate professional and social contact between mathematics teachers and mathematicians from the university and business communities. Recognizing that the Ford Foundation grant would be available only through 1989-90, the Teacher Advisory Committee recommended in 1987-88 that the membership of the society be expanded to include teachers outside the collaborative's geographic boundaries in Minneapolis and St. Paul. It is hoped that this expansion will lead to a self-supporting society.

Each year, the society has sponsored a series of successful dinner meetings for collaborative teachers and members of the larger mathematics community. Initially, society dinners were offered free of charge. In 1987-88, however, a fee of $5, half the cost of the dinner, was instituted for collaborative members, while non-collaborative teachers paid the full cost. Beginning in fall, 1988, all participants were required to pay the full cost of the dinner, which averaged about $10.

Four dinner meetings were held during the 1988-89 academic year. The meetings were planned and coordinated by on-site observer Gerry Sell, with the assistance of the Building Representatives. At the end of the year, the collaborative conducted a teacher survey to evaluate the TCMS dinner meetings. Topics covered by the survey included the primary reasons teachers attend the meetings; the types of speakers preferred; preferences regarding dinner locations; and the number of dinner meetings teachers would like to attend each year. Results of the survey will be used to plan the TCMS dinner meetings for the 1989-90 academic year.

### November 15, 1988 Dinner Meeting

The first TCMS dinner meeting for the 1988-89 academic year was held November 15, 1988, at the Science Museum of Minneapolis-St. Paul. In a presentation following dinner, Gary Nielson, the staff member of the Boston Museum who was responsible for the creation of the Robotics Exhibit, shared his insights about student learning.
After his talk, Mr. Nielson conducted a tour of the exhibit, which is on loan from the Boston Museum.

Sixty people attended the dinner meeting, including five representatives from the university community and four from business and industry. While there were 75 paid reservations, severe weather conditions prevented several people from attending.

The response to the evening was extremely favorable. The participants appreciated both the opportunity to tour the exhibit and the remarks by the guest speaker. One teacher commented, "The speaker was both stimulating and entertaining--good introduction to exhibit . . . ." Another teacher said, "Beautiful place, good food, great idea for a meeting. Let's do this again for a different exhibit." A third teacher remarked, "Speaker was entertaining. His nontechnical presentation was easy to follow and I appreciated his remarks about how he became interested in science. Especially appreciated his story of how he learned outside and not inside the classroom." A fourth teacher noted, "A delightful talk about why we learn and how we need to reach our students [and teach them] to want to learn . . . ." The on-site observer reported, "The activity was a winner except for the weather. The speaker was very good, and with a great deal of humor, described his student days as a 'hands on' learner being confined to his seat and never allowed to touch anything."

## March 1, 1989 Dinner Meeting

The second TCMS dinner meeting was held March 1, 1989, in the Gourmet Dining Room of the Minneapolis Technical Institute. Professor Suzanne Molnar of the College of St. Catherine had been scheduled to speak on combinatorics--numbers that count--but became ill. Professor of Mathematics Wayne Roberts agreed to speak on Calculus Reform. Dr. Roberts' lecture followed a social hour and dinner.

Approximately 70 people attended the dinner meeting. The on-site observer reported, "This was a real winner. Wayne Roberts gave one of the best talks about calculus reform. He subbed at the last minute for an ill person. Everyone thought this was great."

## April 6, 1989 Dinner Meeting

The third TCMS dinner meeting was held April 6, 1989, at the Minnesota Club in St. Paul. Fifty-six people attended, including collaborative and non-collaborative teachers and representatives from the business and university communities. Mr. Bill Bush and Mr. Jerry Degerness, both employees of St. Paul Fire and Marine Insurance Company, spoke on "Mathematics at the St. Paul." Mr. Bush described the types of jobs at the St. Paul companies and the mathematics needed to perform these jobs successfully; Mr. Degerness, who is a regular participant at TCMS dinner meetings, presented four examples of problems that company actuaries have to solve. St. Paul Fire and Marine Insurance Company hosted the use of the dining room, as well as one-third of the cost of each dinner.

Participants were very enthusiastic about the evening. One teacher commented that it was the best dinner she had ever attended. Another said, "The food was wonderful and I learned something." A third teacher stated, "I could do this every month and not get bored." A fourth teacher commented, "Great place, great food, great company, great evening." A representative from outside the teaching community commented, "This was such a great evening." The on-site observer reported, "What a winner! This was such a classy and elegant place. I think the teachers really appreciated the fact that St. Paul [Fire and Marine Insurance] Company made their collaborative donation in direct support of teachers rather than by giving the collaborative a donation."

## May 9, 1989 Dinner Meeting

The fourth and final TCMS dinner meeting of the 1988-89 academic year was held May 9, 1989, at the Holiday Inn Metrodome. Professor Suzanne Molnar of the College of St. Catherine, whose illness prevented her from speaking at the March 1 meeting, spoke on combinatorics. Approximately 55 people attended, including several representatives from the local university community as well as Norman Webb and Jan Gamradt from the UMC Documentation Project.

The on-site observer reported that the evening was "a comedy of errors." Problems included inadequate space, insufficient food, no overhead or podium. These difficulties were compounded when a polka band started to play in the next room, drowning out the lecture. "Every evaluation was negative," the on-site observer said. "Needless to say, we'll never host another dinner there." Teachers' comments included: "The room was too small, food uneven, speaker incomprehensible. The whole evening was a '0' if not a minus number," and "If I had never been to a collaborative dinner before, I'd never come again. This was awful."

## Woodrow Wilson Summer Institute on Statistics

From June 27-July 1, 1988, the collaborative sponsored a Woodrow Wilson National Fellowship Foundation Summer Institute on Statistics at the University of Minnesota. The Institute, which focused on providing participants with new statistical techniques that could be used in any classroom, was presented by four Master Teachers who had been trained at Princeton University under the direction of the Woodrow Wilson Foundation.

Enrollment in the Institute was open to collaborative teachers, who were assigned registration priority, NSF Teacher Renewal participants and other mathematics teachers in the Minneapolis metropolitan area. The response was much greater than anticipated. Forty-one teachers, including 30 collaborative junior and senior high teachers, participated. Collaborative teachers received either two graduate credits plus a travel reimbursement or a stipend of $200; in addition, the collaborative covered their $75 registration fees.

During the week-long Institute, the participants used simple numerical and graphical methods to process, organize and analyze real data. Topics included exploratory data analysis, sampling, probability, simulation and inferences.

The Institute was extremely successful. Participants reported that it was very worthwhile and rated it positively in terms of its practical application and the quality of its presentations. There also was a great deal of positive interaction between collaborative and NSF participants. Because of its impact and success, the Institute will serve as a model for sharing resources and opening the collaborative to a larger teacher community. One teacher commented, "The past two months at my school have left me depressed. But Marlys' workshop and this have revitalized me. I owe UMC a big thank you this summer." Another said, "I was worried about this applying to junior high, especially since I convinced two of my colleagues to come. But it does [apply] and it's good." A third teacher added, "I felt like I could have walked out after the first hour and used some of this with my kids. It's great." Some teachers, however, commented that the content was somewhat beyond the level of their students' proficiencies.

Thirty-two of the teachers who attended the 1988 one-week Institute on Statistics responded to an impact questionnaire distributed in February, 1989, by the Woodrow

Wilson National Foundation. Of the respondents, 94 percent indicated that the topics presented, and the materials and teaching techniques demonstrated made the Institute more valuable than other in-service experiences. All of the teachers reported that their knowledge of the content had been increased by the experience and nearly two-thirds of respondents reported that the Institute increased their knowledge of content "a great deal." All except one of the teachers indicated that the Institute increased their interest in curriculum reform, and more than half of the teachers reported that their interest was substantially increased. More than 90 percent of the teachers reported that they had made some content changes in their courses as a result of the Institute, either by adding some new content (44 percent), adding new units (19 percent) or integrating new content throughout the course (31 percent). One teacher commented, "The Institute greatly affected our 8th grade mathematics course. We now start the school year at the back of the book with probability and statistics. This was enthusiastically received by the students--and the teachers." In fact, 88 percent of respondents reported that curriculum changes prompted by the Institute had fostered greater student interest. The quality of the experience was summarized by one teacher: "This one-week workshop has had the same impact on my teaching as my 2 1/2 summers in the NSF classes I took in Minneapolis. The leaders of our session made everyone feel comfortable and fostered an atmosphere of sharing and caring and contributing. Their rapport with each other was evident. Their fine example gave me the courage to apply for this year's session in Princeton and to my delight, I was accepted. I daily find myself reading the newspaper and looking for statistical bits that would interest the students. I find myself adding little bits to class on the uses of such things as percents, graphs, etc. I find myself wanting to change my classes, especially at the junior high level to create more excitement . . . . statistics would be an excellent way. Thank you for the experience."

## Institute Follow-Up

The collaborative sponsored a follow-up meeting for the participants of the Woodrow Wilson Statistics Institute from 8:30 a.m. to 3:30 p.m. April 4, 1989, at Vincent Hall on the University of Minnesota campus. Chris Olson, one of the Master Teachers who presented the Institute, led a discussion on statistical software, the application of statistics, the integration of statistics into the curriculum, and data that can be represented by box plots and stem and leaf graphs at the junior high level.

Attendance at the meeting was very disappointing; only nine of the 24 teachers who had registered for the meeting actually attended. Those who did attend, however, appreciated the opportunity to participate in the discussion and to explain what they had done in their classes based on ideas received from the institutes.

### Woodrow Wilson Summer Institute on Functions Questionnaires

The collaborative will sponsor a Woodrow Wilson Summer Institute on Functions in the summer of 1989. To help plan the event, the collaborative distributed questionnaires to the Building Representatives in October, 1988, and directed them to distribute a copy to teachers who might be interested in attending. The questionnaire asked teachers to express a preference for one of two dates (June 26-30, 1989 or July 10-14, 1989) as well as the type of compensation that might be offered. Collaborative teachers were asked to choose between receiving 1) two upper-division graduate credits plus a small travel stipend; or 2) a stipend of approximately $100-$150 and no credit or travel expenses.

Applications for the Summer Institute were distributed to teachers through the collaborative's March newsletter.

### "Shareabilities"

The collaborative began to assemble a directory of Twin Cities mathematics teachers who are willing to share their knowledge and special materials with their colleagues.

In January, each Building Representative was asked to prepare a list of teachers in his or her building who had something to share; prompts to help the teachers identify "shareabilities" included: "Do you have experience with special teaching strategies? Have you travel experiences? Have you hobbies you like to share/talk about? Do you have special lessons that have made you 'a legend in your own time'? Are you willing to help new coaches with __________? Are you a source of information about any professional societies? Do you have helpful hints on dealing with student teachers?"

The Building Representatives gave their lists to teacher Ms. Marlys Henke at the March meeting, and at the April meeting, Ms. Henke distributed the first draft of the

Shareabilities and asked for suggestions regarding format and editing. The directory will be distributed in Fall, 1989.

**Local, Regional and National Conferences**

Mathematics Equity Conference

On April 5, 1989, the Minnesota Mathematics Mobilization ($M^3$) and the MPS sponsored an all-day conference on Mathematics Equity at the Hilton Inn. The conference was a follow-up to an Equity Conference the American Association for the Advancement of Science (AAAS) had sponsored in September, 1989. Lloyd Elm, principal of a Native American Indian magnet school in Buffalo, New York, was the keynote speaker. Many of the participants were Native American Indians, Hispanics or Asians. The conference was organized by Ross Taylor, Minneapolis mathematics consultant.

The collaborative sponsored the attendance of a total of four junior and senior high school teachers. In addition, MPS sent one teacher from each junior and senior high school. The on-site observer reported that the conference was very successful. "This was a conference at which things got done. Even at lunch every person representing a program gave the information on how to 'plug in' . . . ." Programs such as Equals, Math League, Family Math, and Operation Smart, as well as Minority Student Coordinators from colleges in the Twin Cities area were represented.

Annual Meeting of the National Council of Teachers of Mathematics (NCTM)

The Twin Cities collaborative awarded grants of $100 each to eight collaborative teachers to help fund their attendance at the NCTM conference in Orlando, Florida, April 12-15, 1989. The collaborative had received $600 from EDC to award to teachers who wanted to attend the conference. When eight teachers expressed interest, the TCUMC Governing Board, on recommendation of the Building Representatives, voted to allocate $100 toward the expenses of each of the two additional teachers. Grant recipients were asked to attend meetings held by EDC during the conference for members of the UMC network and each was required to write a report about these meetings for the TCUMC newsletter. In most cases, schools covered the costs of substitute teachers through the principals' discretionary funds. Collaborative teacher Cathy Wick, a member of the Building Representatives Executive Committee, was asked to represent the collaborative at the UMC Coordinators' Meeting scheduled during the conference.

The theme of the conference was "Vision for the World of School Mathematics." During the day, the teachers attended a wide variety of sessions, and three TCUMC teachers made presentations. In the evenings, the teachers participated in sessions with members of the other ten collaboratives from across the country. These sessions, which were sponsored by the UMC Technical Assistance Project, focused on the issue of equity in mathematics and on the Australian Mathematics Curriculum and Teaching Program.

The teachers reported that the conference was very worthwhile and that they felt proud of what the Twin Cities collaborative has accomplished. In an article that appeared in the June issue of the TCUMC newsletter, Cathy Wick wrote, "I was pleased to represent TCUMC at the [Coordinators'] meeting. I decided that we in the Twin Cities are very fortunate. We have an active membership, strong and valuable ties to the university, varied activities, and a range of opportunities available to our members. We are doing a great deal. There is more to be done."

### MCTM Spring Conference

The Minnesota Council of Teachers of Mathematics (MCTM) held its first two-day conference at Cragun's Conference Center in Brainerd, Minnesota, on April 28-29, 1989. The theme of the conference was "Spring Into Mathematics." In the keynote address, Dr. Zal Usiskin, Director of the University of Chicago School Mathematics Project, discussed current mathematics education and directions for the future.

During the sessions on Friday and Saturday, national and state leaders spoke on various aspects of the NCTM Curriculum and Evaluation Standards and Everybody Counts documents and on the Minnesota Model Learner Outcomes; participants also attended a variety of practical workshops focused on instructional ideas. Dr. Usiskin and James Flanders, also from the Chicago Project, led several conference sessions. Other nationally known out-of-state speakers included: Dorothy Strong, Chicago Public Schools; Diane Briars, Director of Mathematics, Pittsburgh, PA; Gail Burrill, NCTM

Quantitative Literacy Project; Tom Romberg, Chair of NCTM Standards committee; Don Chambers, Wisconsin Department of Public Instruction; Glenda Lappan, Michigan State University; Betty Cheely, Center for Innovation in Education, California; and Ted Nelson, co-director of Math in the Mind's Eye curriculum. Concurrent with the Friday sessions, $M^3$ held a leadership workshop at Cragun's to address the implementation of the NCTM Standards in Minnesota.

The conference was a huge success. Registration was so great that by early April it had to be closed. Approximately 500 teachers attended; for 300 of them, it was their first mathematics conference. In spite of the fact that registration was more than twice as great as had been anticipated, the conference went very well. Evaluations indicate that participants were pleased with the program, the speakers and the location. In an article about the conference that appeared in the June, 1989, TCUMC newsletter, a collaborative teacher wrote, "This was so well-organized! I have attended conferences for the past four years and found this one MCTM conference more valuable than all the others! Great presenters who knew their material and were enthusiastic in their presentations. Thanks for some very useful ideas and facts."

## Discussion on NCTM Standards

On May 16, 1989, 64 mathematics educators from Minnesota gathered to discuss the state's response to the recommendations outlined in the NCTM Standards. Representatives of K-12 classroom teachers, higher education, business and industry from the state's 11 ECSU regions spent the day analyzing needs, setting priorities and finalizing the most immediate recommendations for change. These included discussions about the Model Learner Outcomes for Mathematics Education, assessment, the proposed rule change for graduation requirements, and ways to increase the awareness of the Standards statewide. The meeting was hosted by Honeywell, Incorporated.

## Collaborative Newsletter

An important networking component of the Twin Cities Mathematics Collaborative is the collaborative's newsletter, The Pentagon Papers. The newsletter, which was first published in December, 1985, under the name "Urban Mathematics Collaborative Newsletter," continues to be a primary source of information for the entire collaborative membership. In 1987, with the appointment of a teacher coordinator who would provide assistance to newsletter editor and on-site observer Gerry Sell, the newsletter was expanded to five issues annually. In December, 1988, the TCUMC Governing Board reassigned the newsletter to Collaborative Coordinator Dr. Phillip Carlson, as part of the collaborative's contract with the Special Projects Office in the School of Mathematics. Ms. Sell and Ms. Sloan produced the final version of their newsletter in January, 1989, and the first version of the new The Pentagon Papers appeared in February.

The first page of the two-page newsletter includes a calendar of events. Articles report on meetings and activities that have taken place and address mathematics-related issues. The March newsletter, for example, included an article on equity and excellence in mathematics education, and the June issue included an article on overcoming computer anxiety.

The Pentagon Papers is mailed to more than 400 addresses, including all TCUMC teachers, as well as industrial, business, university, college and school administrative personnel. Approximately 260 secondary mathematics teachers, including 50 private and parochial teachers, were on the mailing list. In May, 1989, the Special Projects Office distributed a questionnaire to update the mailing list.

## E. Observations

### Project Management

The process of defining a permanent structure for the Twin Cities Urban Mathematics Collaborative resulted in a bicameral form of governance; the two bodies with governing responsibilities are the Governing Board and the Building Representatives. The Governing Board makes policy decisions and administers the collaborative's budget, including overseeing fund raising. The Building Representatives group develops program ideas and serves as a conduit for teachers' input into the collaborative. In 1988-89 the two governing groups operated jointly, making adjustments during the year as they addressed collaborative issues. This bicameral structure provides an interesting study of a collaborative governing structure.

The Governing Board has the authority to make major decisions for the collaborative and to set policy. The Board has a formal structure with designated officers; members are selected to ensure balanced representation of key groups. Its meetings, which are held quarterly, are agenda-driven and follow standard parliamentary procedure. Decisions are made by a majority vote of all members present. Meetings are generally limited to two hours. The group this year established an Executive Committee to meet between the regular Board meetings to address those issues that needed more thought and discussion than could be carried out in its two-hour meetings, or situations that developed that required action before the next quarterly meeting of the Board. Not all of the Board positions were filled at the beginning of the school year, as the group expanded its membership as people were identified who had an interest and who could represent a particular constituency. A position was added during the year to represent private school mathematics teachers, for example; this decision recognizes the active role that private school teachers play in the collaborative.

It is important to note that the Governing Board is the major decision-making body of the collaborative and that its chair serves the function of the director in other collaboratives. Former Collaborative Director Harvey Keynes views himself as a fiscal agent who monitors the budget and the administrative details. Steve Watson, as chair of the Governing Board, has assumed the major responsibility for the collaborative. Both Professor Keynes and Mr. Watson insist that the Governing Board make all key decisions, and they regularly wait for the next meeting or at least to poll the Executive Committee before taking action. This is different from the form of governance in other collaboratives where the action of the director and coordinator are affirmed by the governing body rather than made unilaterally by the group. In carrying out the business of the collaborative, there is a need for Mr. Watson and Professor Keynes to meet regularly. It appears that some of the teachers perceive these meetings as efforts to control the collaborative, when in reality decisions are made exclusively by the Governing Board or its Executive Committee.

The second group that helps to govern the collaborative is the Building Representatives, composed only of teachers. The Building Representatives group fills multiple roles that do not always complement one another. One function of the Building Representatives is to provide a teacher network in which group members share with one another and communicate group decisions to other teachers at their schools. A second function of the Building Representatives is to generate plans and ideas for teachers and for the collaborative, and to submit these proposals to the Governing Board for its approval.

The Building Representatives group has its own formal structure, with elected officers, regularly scheduled meetings, and a membership provision for one teacher from each school. In general, building representatives are volunteers who are interested in the collaborative and who want to establish professional relationships with other teachers. The group is predominately female. By necessity of its networking function, group membership was determined by the number of collaborative schools. Unfortunately, however, such a large group can be unwieldy in program planning and formulating proposals for the Governing Board. In light of this, the Building Representatives made some structural adjustments during the year, including forming an Executive Committee to help direct the group's planning process and to shift the leadership due to the illness of the chairperson.

A working relationship between the Governing Board and the Building Representatives is evolving, but its development has been the source of stress on occasion. The leadership of the Governing Board expects the Building Representatives to develop their own program; to support this effort, the Board allocated $3,000 to the group to spend during the year. By May, 1989, however, only $400 had been spent. This was discussed at the May Governing Board meeting, and group members raised questions as to whether the Building Representatives had firm plans or an agenda; one reason for the apparent lag in activity was the Building Representatives' unanticipated change in leadership, a factor that was acknowledged by the Board.

A second issue that emerged during the year was, in fact, the culmination of a number of years of confusion over the responsibilities of the coordinator's position. Traditionally, the coordinator for the TCUMC has been a part-time position associated with the Special Projects Office. This person has overseen administrative details such as arranging for meeting places, preparing and distributing minutes, and notifying teachers of important events. Members of the Building Representatives group view the coordinator as an individual who should meet with them and help provide leadership, both in planning and in ensuring that plans are carried out.

Many Building Representatives perceive the need for greater administrative support. The minutes of the Building Representatives' meetings were to be typed and distributed, but this did not always occur; as a result, some Building Representatives felt that they were not receiving the administrative support they needed. This concern was tied to the need for a clear definition of the role of the coordinator. It should be noted that teachers' working conditions also may have contributed to the value Building Representatives placed on clerical support and administrative detail; limited access to a copy machine, lack of free time and restrictions on equipment use for nonschool business mean teachers often are unable to take care of clerical tasks independently or efficiently. One teacher, for example, commented, "I cannot ask my principal if I could do a mailing to all the schools in Minneapolis and St. Paul. That would not be a reasonable burden on his budget, as small as that would be." Preparation and distribution of the minutes may have seemed a minor task, but for the teachers it was a valuable and necessary service. Some of these views were discussed at the May meeting of the Building Representatives and then reported at the May Governing Board meeting. The Executive Committee of the Governing Board was established, at least in part, in response to these concerns. One of the Executive Committee's initial tasks was to draft a position description for a coordinator that embodied both the leadership role and administrative tasks.

In general, the collaborative's bicameral governing structure worked effectively after these adjustments were achieved. What remains necessary, however, is a mode of operations that would enable the Building Representatives to meet the expectations their colleagues hold of them. Such strategies may include subcommittees to plan programs and develop proposals for consideration by the entire group. In addition, communication and collegiality between the two governing bodies could be enhanced through opportunities for informal interaction and socializing. Finally, a more active, focused Building Representatives group may foster greater understanding of teachers' viewpoints among representatives from business and higher education. It appears that many appropriate adjustments were made during the year. It will be interesting to see what bridges will be built between the two groups in the future.

## Collaboration

The structure of the Twin Cities Urban Mathematics Collaborative incorporates components that include governance, activities, and outreach, each of which fosters a different form of collaboration. One level of collaboration, probably the most intense, occurs among teachers. Four of the eleven collaboratives, including TCUMC, encompass two school districts. TCUMC activities allow teachers to interact with their colleagues from other schools as well as other districts. Meeting with teachers from another city is cited frequently as one of the benefits of collaborative membership. A Minneapolis teacher commented, ". . . when we got both Minneapolis and St. Paul teachers together a whole new area of information opened up for both of us. And we would say, 'Well, gee, in St. Paul we don't have your benchmark tests, now how is that working?" ' A St. Paul teacher made a similar point: ". . . any time you get teachers from St. Paul and Minneapolis together there is a lot of sharing of ideas. I wouldn't have done that if it hadn't been for the collaborative." Teachers develop a slightly different perspective on teaching as they become acquainted with teachers from another system, even though the two districts are similar in many respects. This broadened perspective is further advanced by including teachers from private schools in TCUMC.

A number of activities sponsored by the collaborative have encouraged interaction among teachers. These include the Summer Institute, Twin Cities Mathematics Society dinners, and meetings of the Building Representatives, each of which provides a different form of interaction. As participants in the Institutes, teachers learn and study content and teaching techniques. They interact with one another, discussing the applicability of content and materials to their classrooms. The TCMS dinners provide an opportunity to socialize within the context of a mathematics event; on many occasions, a pleasant environment and a good meal appear to be as important to participants as the presentation of the speaker. Because the dinners are scheduled regularly and do not require a long-term commitment, they provide easy access to the collaborative. The Building Representatives group is also a mechanism by which teachers can work together and network. As part of the Building Representatives group, teachers address issues they have identified as important; examples include the general mathematics curriculum, stipends for an event, and the acceleration of students. In addition, the collaborative newsletter keeps teachers informed about opportunities available to them.

Representatives from higher education continue to be very active in the collaborative. They have been called upon to lead institutes and to make dinner presentations. They participate actively on the Governing Board, developing policy for the collaborative; in the process they interact with teachers and others. Commenting on his involvement on the Governing Board, a representative from higher education was realistic, noting that, like any committee, some things were interesting while others were not. The collaboration that has emerged between teachers and those in higher education has primarily placed higher educators in the role of resources. Participation on the Board provides the major opportunity for teachers and those from the other sectors to interact with one another in a context in which all have equal standing.

A small number of representatives from the business community continue to attend the Mathematics Society Dinners. The St. Paul Fire and Marine Insurance Company hosted one of these dinners, indicating its strong support for the collaborative. This particular event appears to have had an impact on some teachers' understanding of the use of mathematics in the workplace. One teacher responded to a question about how interactions with representatives from business and industry affected his or her conception of mathematics: "The most outstanding one was with the St. Paul Company . . . . I learned what an actuary does, how many they employ, where, why, and how."

In addition to the role they play in the TCMS dinners, business and industry also participate on the Governing Board. Mr. Steve Watson, chair of the Governing Board, provides a strong link between the collaborative and the Minnesota High Technology Council, a collective of representatives from 110 high technology companies throughout Minnesota. Support from the business community has enabled the TCUMC to generate sufficient funds to maintain its level of operations. While the collaborative has not regularly sponsored site visits or developed a teacher-internship program to promote teacher-business interaction as other collaboratives have, teachers feel that they have had some access to those from business and industry. As one teacher noted, "[The Collaborative] has provided a channel to business and industry . . . ."

This year, the collaborative cooperated with the business community, state agencies and mathematics education organizations to present press conferences on the NCTM Curriculum and Evaluation Standards around the state. This collaborative activity not only furthered the awareness of education reform, but highlighted the state's influence on schooling within the Twin Cities. This is an example of an executive decision made by the Governing Board that enables the collaborative to take political stands.

## Professionalism

The collaborative has fostered a professional climate for mathematics teachers in the Twin Cities; the Mathematics Society dinners have played a key role in this accomplishment. Teachers value the time to visit, but they also value receiving information from experts on mathematics. A St. Paul senior high school teacher said he liked hearing about mathematics because it made him feel he was part of a larger community and it gave him something to think about beyond the day-to-day classroom problems. A Minneapolis senior high school teacher associates the discussion of mathematics at the dinners with professionalism. This teacher commented, "We have business representatives who have dinner with us four to five times a year . . . . We are professional in the sense that we look at pure mathematics for an evening, not mathematics education . . . you are an equal." This teacher went on to explain her view of how others view teachers: "For a change you are not 'just a teacher' which is the general attitude in school districts. The population tends to treat you as pretty minor influence in the world. For all the responsibility we carry, it is not a high prestige position." The success of the Mathematics Society dinners in enhancing the professionalism of teachers centers on their ability to focus the attention of teachers and representatives from higher education, business, and industry on a single topic in an environment in which all are able to participate without a stratification of roles.

The issue of stipends is related to teachers' view of professionalism. Some teachers feel that the collaborative has contributed to a sense of professionalism because it provides compensation for attending summer institutes and workshops. Others, however, feel that current stipends are inadequate and, in fact, demean the profession by being so low. It should be noted that the stipends paid by the Twin Cities Urban Mathematics Collaborative are among the smallest of the eleven collaboratives. Only 26 percent of the TCUMC teachers who responded to the background questionnaire reported that they had received stipends for professional development, compared to 37 percent across all collaboratives. Even though the TCUMC does not provide as many teachers stipends as do other collaboratives, the teacher who argued that the stipends were insufficient was voted down by the other Building Representatives; this suggests that a number of Twin Cities mathematics teachers appreciate receiving what they do get, partly because the activities they are attending have been of such high quality.

The Building Representatives group provides the teachers with an opportunity to develop programs independently and to initiate activities. During the school year, the Building Representative established Shareabilities to benefit area teachers. The group had some difficulty setting goals, however, in part because of the disruption caused by the illness of the chair in December. It is yet to be seen what this group will be able to accomplish under consistent leadership. In this regard, the Building Representatives group has not yet reached its full potential.

The different forces within the collaborative--the administrative director and project coordinator, the Governing Board, and the Building Representatives--provide insights into the relationships that emerge among various subgroups as they develop, and into the structural constraints that teachers face. As mentioned under the section on Project Management, the collaborative administration and Governing Board leadership have urged the Building Representatives to develop and implement a course of action. The Building Representatives, however, view themselves as a planning group rather than a decision-making body. It may be that the Building Representatives have achieved a strong brainstorming capacity but have not yet reached the point of strategic planning necessary to follow through on their ideas. This may be attributed to several factors, including teachers' lack of time beyond their teaching, the difficulty teachers have getting together other than at the scheduled meetings, little if any access to phones during the day, and the lack of clerical support. Delegation of tasks is rarely a part of teaching, but delegation and strategic planning are important in developing programs; it may be that the Building Representatives simply need to become more experienced in the skills needed for the implementation of their ideas. In contrast, many of the members of the Governing Board work in an environment in which both delegation and strategic planning are the rule, rather than the exception.

One issue that seems to be facing TCUMC is how to provide opportunities for Building Representatives to learn from mathematicians in the other sectors so that they will be able to identify and implement the ideas important to teachers. In many of the collaboratives, it is the role of the coordinator to guide teachers as they learn how to implement an idea. In the Twin Cities collaborative, the coordinator has been more of an administrative assistant to the project director, than an advocate for or a liaison with the teachers. It remains to be seen how the Building Representatives group will evolve and how it will function under stable leadership. It will be important to see how this group relates to and interacts with the Governing Board as well as with the project's administrative director and coordinator.

**Mathematics Focus**

The mathematics focus for TCUMC was less defined in 1988-89 than it had been in previous years, when a clear emphasis on problem solving had guided the Summer Institutes and some of the other activities; in 1988-89, greater emphasis was placed on developing an organizational structure than on addressing specific mathematics issues. Even so, a variety of activities related to a range of mathematical topics were made available to teachers. The Mathematics Society dinner meetings continued to offer presentations on mathematics or related topics that included robotics, calculus curriculum reform, mathematics requirements for insurance company employees, and combinatorics. Teachers were encouraged and supported to attend conferences in the Twin Cities area, as well as in other parts of the country. Some of these conferences focused on equity or curriculum reform related to recommendations from the NCTM Curriculum and Evaluation Standards. The 1988 Woodrow Wilson One-Week Institute focused on statistics. Also in the summer of 1988, as reported in the annual report for 1987-88, collaborative teachers participated in a workshop on the pre-calculus program from the North Carolina School of Science and Mathematics.

It is clear that the Twin Cities Urban Mathematics Collaborative has influenced teachers in their views of mathematics and on the applications of mathematics. In previous years, teachers had described an increased focus on problem solving as a result of their collaborative experiences. In 1988-89 teachers continued to note benefits that they attribute to the collaborative, including an increased understanding of how mathematics is used and an expanded notion of what to include as school mathematics. One teacher noted a change in her conception of mathematics as a result of the TCMS dinners, ". . . I didn't know business and industry hired 'mathematicians.' I thought mathematics majors were teachers, engineers, or actuaries." A second teacher reported, "The collaborative has introduced me to areas of math not usually taught in high school, so I now think of data gathering and analysis and statistics as part of a good math experience."

Collaborative teachers are concerned about students who are struggling or seem to have little motivation to learn mathematics. One experienced teacher of over 25 years reported that students seemed to have changed over time and that now there are a greater number who say that they do not want to do mathematics; this teacher finds it very difficult to work with these students. At another senior high school, a teacher reported a change in demographics and in the mathematics ability levels of students. In the past, nearly all of the ninth grade students took algebra; now only a small percentage of them take it, and those who do experience a high failure rate. Some of the collaborative's focus has been directed toward the lower achievers in mathematics as evidenced by discussions of equity and the Building Representatives' discussion of the general mathematics curriculum. As one teacher commented, "I don't feel we remediate our less-capable students well. We are trying to address these issues, encourage minorities and women, use problem solving, etc."

The collaborative is one of the forces that has kept issues before TCUMC teachers and informed them of current recommendations in mathematics education. When interviewed, collaborative teachers expressed a view that coincides with recommendations for more experiential mathematics and for having students do more mathematics at an earlier age by reducing the repetition in the school mathematics curriculum. "Too much time is spent on remediation, presenting math in the same way that the students have not understood the first five times," said one frequent participant in the collaborative. She then went on to observe, " We need lots more hands-on activities that must be used by the teachers, not just an option." Another teacher stressed, "In junior high we need to focus much less on arithmetic and start teaching more mathematics. It's difficult to get students excited about something they have learned before."

Another junior high school teacher admitted that she has always had trouble with computing. Her high school mathematics background extended only as far as Algebra I. When she decided to get a teaching certificate in mathematics, she taught herself Geometry, Algebra II, and Statistics analysis over the summer so that she could begin college by taking pre-calculus. Her own experience led her to realize that a high facility in computation is not a prerequisite for doing well in more abstract mathematics. She likes to teach remedial classes and recognizes that she needs to teach these students thinking and problem solving. This teacher was working on a master's degree and was taking an 11-week night course in group theory.

Teachers report that the collaborative has introduced them to a mathematics that has not traditionally been part of the curriculum. Teachers who have been active participants in the collaborative express views of the curriculum and teaching that are very much aligned with the current reform movements in mathematics. The collaborative has been successful in raising teachers' awareness of mathematical issues, particularly through its sponsorship of teachers' attendance at Summer Institutes.

Toward the end of the year, greater attention was paid to issues of equity related to providing mathematics for all students. This seems very timely for the Twin Cities area as teachers are noticing a changing student population that is having greater difficulty in mathematics. The 1988-89 school year was a transition year for the collaborative as it tested and evaluated its restructured Governing Board. It also seemed to be a transition year for the Twin Cities demographic composition; as the population shifts, issues of equity and mathematics reform for all students will become increasingly relevant topics of discussion.

## F. Next Steps

During 1989-90, the Twin Cities Urban Mathematics Collaborative will continue to sponsor a range of activities. In July, collaborative teachers will attend a Woodrow Wilson One-week Summer Institute on Functions and Technology, and two teachers will attend a one-day workshop by Professor Frank Demanna of Ohio State University, entitled "Using the Graphing Calculator in the Precollege Curriculum." In August, three teachers will attend the UMC Leadership Conference in Newton, Massachusetts. The Twin Cities Mathematics Society will continue to hold quarterly dinner meetings. At the first dinner meeting for the 1989-90 school year, two teachers will present materials from the UMC Leadership Conference. At the second dinner meeting in February, 1990, a mathematics professor from Macalester will speak.

The Governing Board will meet quarterly. It will be the task of the Governing Board in 1989-90 to fill the position of collaborative coordinator. The Governing Board's Executive Committee will meet monthly. The Executive Committee, with the assistance of some additional teachers, will submit a proposal to EDC for an outreach grant. The Building Representatives will meet monthly; its executive committee will meet as needed. The collaborative will sponsor a Leadership Workshop in December, 1989, for both members of the Governing Board and Building Representatives. Staff from EDC will participate in this workshop.